SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 23
DECEMBER 1, 1970

W70-09511 -- W70-10033

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SELECTED
WATER RESOURCES ABSTRACTS

'A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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e of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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WATER CYCLE

General

LE EFFECTS IN THE PHYSICAL MODEL- OF SURFACE RUNOFF,
ssachusetts Inst. of Tech., Cambridge. Dept. of l Engineering.
tor M. Graveto, and Peter S. Eagleson.
ssachusetts Institute of Technology, lrodynamics Laboratory Report No 120, ruary 1970. 328 p, 115 fig, 29 tab, 48 ref, ap- d.

scriptors: *Model studies, *Rainfall-runoff rela- ships, *Hydraulic models, *Hydraulic ilitude, Analytical techniques, Prototype tests, ughness (Hydraulic), Viscosity, Gravity, Wetta- ty, Surface tension, Computer programs.
ntifiers: Model scale-effects, Kinematic wave ory.

e feasibility of scale modeling of the rainfall-sur- e runoff process was investigated using a plane, permeable model and an analytical prototype. e dynamic similarity criteria of previous in- stigators were examined and a new similarity rameter describing the influence of surface ten- n and surface wettability is introduced. The con- llable similarity parameters were varied in a tematic way to evaluate scale effects through a mparison of the model and prototype hydro- aphs in dimensionless form. Surface tension ef- cts were studied using materials of different ttability and by coating the surface of the atershed with wetting agent solutions. Surface ughness effects were studied using smooth and ndroughened surfaces. It is possible to select odel materials and operating conditions such that all scale models can be used to study overland ow with acceptable accuracy. (Knapp-USGS)
70-09538

HANGING CLIMATE,
and Corp., Santa Monica, Calif.
O. Fletcher.
and Corporation, Paper P-3933, September 968. 27 p, 60 ref.

escriptors: *Climates, *Air circulation, Precipitation (Atmospheric), *Air temperature, e, Water temperature, Rainfall, Fishing, Humidi- , Arctic, Winds, Heat transfer, Smog, Weather ata, Model studies, Solar radiation, Carbon diox- le, Cloud cover, Turbidity, Evaporation, Cloud eeding, Mathematical models, Heat budget.

he fact that the global climate is changing is illus- rated by the northward displacement of the ice oundary during the first three decades of this cen- ury. Both the general vigor of the global at- nospheric circulation and the variations of sea sur- ace temperatures in response to changing at- nospheric circulation are connecting factors that nake possible a rational description of global cli- nate. Other variations that cause climate dif- erences involve changes in the zone of cold water t the equator, the extent of ice on the ocean, the egree of atmospheric dirtiness, and the rotation ate of the earth on its axis. Man is inadvertently in- luencing global climate by his increased CO2 roduction causing global warming called the greenhouse effect'. A 10% change in CO2 can be ompensated by a 3% change in water vapor or a % change in mean cloudiness. Recent global cool- ng shows that this has already occurred. Other nan-made climatic influences include smog, air- craft exhaust, and ship fuel releases. Purposeful in- luencing of global climate has already been achieved on a small scale; however, today's ad- vanced technology allows for much greater achievements as the Soviet Union currently emphasizes. (Osborne-Vanderbilt)
W70-09599

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS: PART 2 - THE BROSNA CATCHMENT AT FERBANE,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 06A.
W70-09698

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
S. Bravo, A. Carlos, Brendan M. Harley, Frank E. Perkins, and Peter S. Eagleson.
Available from the NTIS as PB-194 289, $3.00 in paper copy, $0.65 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 123, June 1970. 147 p, 40 fig, 4 tab, 18 ref, 5 append. OWRR Project C-1069, Grant No 14-01-0001-1576.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, *Systems analysis, Open channel flow, Unsteady flow, Linear programming, Routing, Unit hydrographs, Computer programs, Input-output analysis, Simulation analysis, Synthetic hydrology.
Identifiers: Kinematic wave models.

A distributed linear model of direct catchment runoff simulates complex drainage areas by a network of overland flow and streamflow elements in which the one-dimensional equations for unsteady flow in a channel are assumed to govern. Solutions of these equations for suitable boundary conditions are obtained in the form of unit impulse response functions. Based on linear systems theory, any output may be estimated by performing the convolution operation between these impulse response functions and given inflows. The linear model was introduced into the M.I.T. Catchment Model as an alternative to the existing kinematic model. Results obtained with the linear model were compared with results using some non-linear solutions. (Knapp-USGS)
W70-09831

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).

Monica Krippner, Editor. Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, 1967. 740 p.

Descriptors: *Conferences, *Radioactivity techniques, *Tracers, *Tracking techniques, *Radioactive dating, Hydrology, Hydrogeology, Surface waters, Groundwater, Groundwater movement, Streamflow, Reservoirs, Seepage, Stable isotopes, Radioisotopes.
Identifiers: Isotope techniques (Hydrology).

Proceedings of a Symposium on isotopes techniques in hydrology, organized by the IAEA in co-operation with the International Union of Geodesy and Geophysics and held in Vienna, November 14-18, 1966 is presented. The meeting was attended by 167 participants from 36 countries and 7 international organizations. The topics discussed include hydrometeorology, streamflow measurements (7 papers); sediment studies (10 papers); geochronology and environmental studies (10 papers); aquifer characteristics (5 papers); unsaturated zone, seepage, tracer technology (6 papers); surface water, limnology, glaciology (3 papers). Each paper is in its original language (30 English, 9 French and 2 Russian) and is preceded by an abstract in English and one in the original language if this is not English. Discussions are in English. (See also W70-09869 thru W70-09887). (Knapp-USGS)
W70-09868

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 07B.
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
For primary bibliographic entry see Field 07B.
W70-09870

MODIFICATION OF THE ISOTOPIC COMPOSITION OF RAINWATER BY PROCESSES WHICH OCCUR BEFORE GROUNDWATER RECHARGE,
Weizmann Inst. of Science, Rehovoth, (Israel).
For primary bibliographic entry see Field 02K.
W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
Illinois State Water Survey, Urbana.
G. E. Stout, and F. A. Huff.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/6, p 61-72, 1967. 12 p, 4 fig, 5 tab, 10 ref.

Descriptors: *Fallout, *Rainfall, *Tracers, *Strorms, *Tracking techniques, Data collections, Sampling, Radioisotopes.
Identifiers: Rainout.

During a 4-yr period extensive areal and time sampling was performed of the radioactivity in rainwater in central United States of America. Many surface observations and some airborne water collections were made. It is evident from the data that great variations in rainout are likely during convective storm periods and that those engaged in atmospheric tracer studies must exercise extreme care in the interpretation of observational data because of the natural variability in such storms. Analyses of spatial variability showed a trend for the relative variability of radioactive rainout to: (1) exceed the storm rainfall variability, (2) decrease with increasing rainfall volume and storm duration, and (3) increase with increasing network size. Point representativeness indicating an average error of 20-25% is introduced when a single observation is assumed to represent the mean rainout over areas of 10-12 square miles. The rainout on 26 May, 1965 after the Chinese bomb test is used illustrate the distribution of rainout in time and space over a small network of five recording air-and water-sampling sites in an area of 36 square miles. Airborne observations are also discussed. A classification of the types of time distributions of rainout is proposed, based upon a large sample of observational data. (See also W70-09868) (Knapp-USGS)
W70-09872

ESTIMATING THE TRITIUM INPUT TO GROUNDWATER FROM WINE SAMPLES: GROUNDWATER AND DIRECT RUN-OFF CONTRIBUTION TO CENTRAL EUROPEAN SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches Institut.
For primary bibliographic entry see Field 02F.
W70-09873

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
For primary bibliographic entry see Field 02E.
W70-09874

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
For primary bibliographic entry see Field 02J.
W70-09876

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 02L.
W70-09877

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05A.
W70-09878

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 07B.
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
For primary bibliographic entry see Field 02J.
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09881

INVESTIGATION INTO THE MOVEMENT OF FLUVIAL BED-LOAD WITH RADIOISOTOPES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02J.
W70-09882

A CONTRIBUTION TO THE KINETIC THEORY OF BED-MATERIAL DISCHARGE,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02J.
W70-09883

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
For primary bibliographic entry see Field 02J.
W70-09884

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut.
For primary bibliographic entry see Field 02F.
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02F.
W70-09886

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
For primary bibliographic entry see Field 02F.
W70-09887

2B. Precipitation

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 07B.
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
For primary bibliographic entry see Field 07B.
W70-09870

MODIFICATION OF THE ISOTOPIC COMPOSITION OF RAINWATER BY PROCESSES WHICH OCCUR BEFORE GROUNDWATER RECHARGE,
Weizmann Inst. of Science, Rehovoth, (Israel).
For primary bibliographic entry see Field 02K.
W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02A.
W70-09872

WEATHER MODIFICATION POTENTIAL FOR WATER SUPPLY IN THE COLORADO RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
W70-09920

ARIZONA WEATHER MODIFICATION RESEARCH PROGRAM,
Meteorology Research, Inc., Altadena, Calif.
For primary bibliographic entry see Field 03B.
W70-09927

RAINFALL RELIABILITY,
Sheffield Univ. (England). Dept. of Geography.
S. Gregory.
In Environment and Land Use in Africa, Thomas, M.F. and Whittington, G. W. (eds) Chapter 4, p 57-82, Methuen, London, 1969. 7 fig, 4 tab, 34 ref.

Descriptors: *Rainfall, *Statistical methods, *Variability, Tropical regions, Semiarid climates, Climatic data, Climatic zones.
Identifiers: *Africa, *Agricultural planning, *Climate prediction.

Various aspects of tropical African rainfall variability measurements and analyses are examined. A general relationship between mean rainfall and variance is supported but not completely confirmed by available data. It is felt that rainfall variability is best expressed in terms of a linear equation between mean and standard deviation rather than as a percentage relationship because absolute terms have greater relevance to potential agricultural needs. Higher rainfall variability in arid areas is at best a generalization with many exceptions. Rainfall data for these areas is often markedly skewed rather than normally distributed. The general concept of higher variability of tropp rainfall relative to temperate rainfall is not s ported by the data. Many parts of west Africa h no higher rainfall variability than England. Ann and even monthly mean rainfall data do not p vide adequate information for agricultu planning. Rainfall probability studies are urged areas where rainfall amount is normally distribu and adequate dates are available. Appropri statistical techniques are discussed. (Cas Arizona)
W70-09961

2C. Snow, Ice, and Frost

CURRENT TRENDS IN GLACIOLOGY,
Centre National de la Recherche Scientifiq Grenoble (France). Laboratoire de Glaciologie.
L. A. Lliboutry.
Earth-Science Reviews, Vol 6, No 3, p 141-1 June 1970. 27 p, 3 fig, 1 tab, 138 ref.

Descriptors: *Glaciers, *Glaciation, Cryolo Geomorphology, Scour, Regimen, Ablation, I Melting, Movement, Rheology, Snowpacks, C matology, Erosion, Temperature.
Identifiers: *Glaciology.

Glaciology has become a broad interdisciplina science. Major contributions to glaciology duri the last five years are reviewed (131 references a given) and prognoses are made concerning lines future research. The subjects are grouped und the following headings: (1) Field techniques; (Geochemistry and mass balance of polar ice cap (3) Sliding of temperate glaciers and relat problems; (4) Temperature profiles and past hist ry of ice caps; and (5) Glacier erosion and botto drift. (Knapp-USGS)
W70-09533

RELATION BETWEEN EVAPORATION AN SOIL HYDROCONSTANTS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. Hydrology and Hydraulics.
For primary bibliographic entry see Field 02G.
W70-09576

ELECTRICAL CHARGES ON SNOW PART CLES,
Washington Univ., Seattle. Dept. of Atmospher Sciences.
D. A. Burrows, and P. V. Hobbs.
Journal of Geophysical Research, Vol 75, No 24, 4499-4505, August 20, 1970. 7 p, 7 fig, 1 tab, ref. NSF Grant GA-780.

Descriptors: *Snow, *Precipitation (Atmospheric *Cloud physics, *Electrical properties, *Snowfal Crystals, Storms, Weather, Air temperature Lightning.
Identifiers: Electric charges (Particles).

Measurements of the charges on individual air borne snow particles showed that they were dis tributed approximately symmetrically betwee positive and negative values. The majority of th small charges were negative, however, and th majority of the large charges were positive. Th magnitudes of the positive (or the negative charges tended to follow a log-normal distributio The mirror image relationship between the sign o the net charge carried by precipitation and the sig of the atmospheric potential gradient was generall found to hold, but some exceptions were note Even in the exceptional cases, however, changes i the atmospheric potential gradient affected the di tribution of charges. (Knapp-USGS)
W70-09687

TOP WATER AND INTERSOIL RUNOFF O SNOWMELT AND RAINFALL WATER,
Hydrometeorological Research Center, Mosco (USSR).
For primary bibliographic entry see Field 02G.

W70-09710

VARIATIONS IN SOIL MOISTURE STORAGE DURING THE WINTER HALF YEAR,
Technical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water Resources Development.
For primary bibliographic entry see Field 02G.
W70-09711

INFLUENCE OF FREEZING AND THAWING OUT PROCESSES ON MIGRATION AND SOIL MOISTURE CONTENT IN THE UPPER LAYERS OF THE UNSATURATED ZONE,
Hydrometeorological Research Center, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09716

THE ISOTHERMAL COMPRESSIBILITY OF FROZEN SOIL AND ICE TO 30 KILOBARS AT -10 DEGREES C,
Army Terrestrial Sciences Center, Hanover, N.H.
Edwin Chamberlain, and Pieter Hoekstra.
Research supported by Advanced Research Projects Agency of Dept of Defense. Cold Regions Research and Engineering Laboratory Technical Report 225, June 1970. 35 p, 31 fig, 7 tab, 19 ref, append.

Descriptors: *Ice, *Frozen soils, *Strength of materials, *Compressibility, *Compressive strength, Stress analysis, Stress, Permafrost, Analytical techniques, Soil physical properties, Laboratory tests, Mechanical properties, Deformation, Elasticity (Mechanical), Compaction, Piezometry, Pressure.
Identifiers: Ice compressibility.

The isothermal compressibilities of ice and partially and fully saturated sand and silt at -10 deg were determined in a piston-die device with which a uniaxial load is imposed on a lead encapsulated specimen, resulting in the hydrostatic compression of the test specimen. Pressures to 30 kbars were obtained. The compressibility of ice is as reported by P.W. Bridgman. The various phase transformations of ice I to water ice VI to ice VIII appear as expected. It is shown that the compressibility of frozen soil can be readily predicted from the knowledge of material properties such as degree of saturation with ice, porosity, and the compressibilities of the ice and mineral components. (Knapp-USGS)
W70-09849

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
R. A. Freeze, and J. A. Banner.
Canada Inland Waters Branch Report Series No 3, Department of Energy, Mines and Resources, 1970. 29 p, 16 fig, 21 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Frost, Freezing, Thawing, Saturated flow, Unsaturated flow, Recharge, Surface-groundwater relationships, Base flow, Runoff, Water yield, Instrumentation, Infiltration, Hydrogeology, Data collections.
Identifiers: Calgary (Alberta, Canada).

An instrumented experimental site at Calgary, Alberta, Canada provides integrated measurements of the subsurface moisture regime in both the saturated and unsaturated zones. A soil-moisture measuring system utilizing both resistance cells and a neutron probe has advantages over single-instrument systems, particularly in the determination of frost and winter soil-moisture conditions. The site is in a regional groundwater recharge area. The vertical, saturated, hydraulic gradient is 0.45, and it remains remarkably constant through the year. Two mechanisms lead to water-table rises at the site: a direct vertical infiltration to the water table through the unsaturated zone, and a depression-focused recharge involving horizontal infiltration from a nearby slough. Frost formation occurs slowly from the surface down. An ice-water mixture precedes complete freezing. The spring thaw is more rapid but there is a significant remnant of the frost wedge in the ground at the time of peak snowmelt runoff. (Knapp-USGS)
W70-09850

2D. Evaporation and Transpiration

WATER BUDGET ACCOUNTING ON TWO CORN-CROPPED WATERSHEDS,
Agricultural Research Service, Brookings, S. Dak.
C. A. Onstad, and T. C. Olson.
Journal of Soil and Water Conservation, Vol 25, No 4, p 150-152, July-August 1970. 3 p, 3 fig, 5 tab.

Descriptors: *Water balance, *Corn (Field), *Evapotranspiration, Demonstration watersheds, Consumptive use, Soil moisture, Water storage, Water yield, Water conservation, Stubble mulching, Land management, Infiltration, Runoff, Soil-water-plant relationships, Water management (Applied).
Identifiers: Madison (S. Dak.).

The growing-season water budget components of two small corn-cropped watersheds in South Dakota were quantified over a 3-year period. The watersheds normall receive about 20 inches of rain between April 1 and October 31, little of which runs off. Most of the moisture evaporates or transpires. Evaporative demand is highest during June, July, and August, when a loss as much as four times the precipitation creates a moisture stress on corn during its critical growth period. Study data show that corn stover left as surface cover substantially increased the water retained on the watershed. (Knapp-USGS)
W70-09532

WATER TRANSMISSION BY EVAPORATION AND FROST ACTION AT DIFFERENT SOIL CONDITIONS IN SUCTION LYSIMETERS,
For primary bibliographic entry see Field 02G.
W70-09573

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 02G.
W70-09574

EFFECT OF SOIL SALINITY ON THE LOSS OF WATER FROM VEGETATED AND FALLOW SOIL,
Geological Survey, Phoenix, Ariz.
For primary bibliographic entry see Field 02G.
W70-09579

METHODS AND FORMULAS FOR THE DETERMINATION OF SOIL EVAPORATION AND SOIL MOISTURE CONTENT FROM HYDROMETEOROLGICAL DATA,
Hydraulic Research Inst., Bratislava (Czechoslovakia).O
For primary bibliographic entry see Field 02G.
W70-09580

METHODS AND DEVICES FOR MEASURING MOISTURE, EVAPORATION AND AVAILABLE WET RATIO OF SOIL BASED ON THE ANALYSIS OF ITS HEAT REGIME,
Committee for the I.H.D., Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09582

WATER REGIME OF THE SOIL AS AFFECTED BY VEGETATION,
Research Inst. of Agricultural Economics, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W70-09586

POTENTIAL EVAPOTRANSPIRATION OF MAIZE (FRENCH),
Institute of Irrigation Research, Prague (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09587

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 02G.
W70-09588

EVAPOTRANSPIRATION OF PLANTS AND FLUCTUATION OF THE GROUNDWATER TABLE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland). Water Physics Div.
For primary bibliographic entry see Field 02G.
W70-09589

FIRST MEASUREMENTS OF SOIL WATER EVAPORATION WITH THE AID OF LYSIMETERS IN CZECHOSLOVAKIA (FRENCH),
Institute for Protection of Monuments and Nature, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09592

TRANSPIRATION OF SUGAR BEET,
Research Inst. of Irrigation Management, Bratislava (Czechoslovakia).
Vladimir Slama.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 748-759, 1968. 12 p, 7 tab.

Descriptors: *Evapotranspiration, *Water balance, *Sugar beets, Transpiration, On-site tests, Meteorology, Hydrologic budget, Solar radiation, Consumptive use, Moisture content, Soil-water-plant relationships.
Identifiers: Czechoslovakia.

The water requirement of sugar-beet plants was determined at the experimental station at Cakovice near Prague, Czechoslovakia during 1957-1960. In field experiments the balance of soil water was measured at intervals of three or four days during the vegetation period. The smoothed values of the consumptive use were the principal data for expressing the water requirement of sugar-beet in relation to meteorological factors through coefficients applied to the saturation deficit, evaporation and intensity of solar radiation. The consumptive use is expressed for ten-day periods and for periods in which the sum of mean daily temperatures is equal to 200 deg C. The coefficients were used for evaluating the quantity of irrigation water needed for sugar beet, and the measured changes in soil water content agreed well with those calculated. The method should be satisfactory in other regions. (See also W70-09715 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09714

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
D. M. Katz.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium,

The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 822-827, 1968. 6 p, 3 tab, 2 ref.

Descriptors: *Evaporation, *Arid lands, *Lysimeters, Irrigation, Irrigation water, Irrigation programs, Water demand, Consumptive use, Groundwater movement, Soil water movement, Surface-groundwater relationships.
Identifiers: *Groundwater evaporation, Soil water-groundwater relationships.

Lysimeter data are compiled for groundwater discharge and evaporation and transpiration from different types of ground surface (both land without vegetation and with cotton, alfalfa, maize and other irrigated crops). The investigations cover soils of various texture under semidesert and desert climatic conditions, with the water table at a depth of 0.5 to 3 meters. The results of mathematical treatment of the observation data are presented and pertinent regularities are established. (See also W70-09722 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09721

INFLUENCE OF TRANSPIRATION SUPPRESSANTS, SPRINKLER IRRIGATION AND MOISTURE LEVELS ON TRANSPIRATION AND EVAPOTRANSPIRATION,
Texas A and M Univ., College Station.
C. J. Gerard, and S. W. Hipp.
Available from the NTIS as PB-194 238, $3.00 in paper copy, $0.65 in microfiche. Texas A and M University Water Resources Institute Technical Report No 27, May 1970. 101 p, 33 fig, 36 tab, 29 ref. OWRR Project No B-033-TEX (1).

Descriptors: *Evapotranspiration control, *Sprinkler irrigation, Water utilization, Water yield improvement, Water conservation, Tomatoes, Citrus fruits, Texas.
Identifiers: Transpiration suppression.

Light sprinkler cooling water applications and white acrylic paint were applied to leaf canopies of tomatoes and citrus to attempt to reduce evapotranspiration. Moisture use, yields, and microclimatic data were determined. Estimates of influences of treatments on transpiration were evaluated with thermoelectric sensors. Tomato and citrus plant parts were analyzed for chemical effects of treatment. Diurnal changes in citrus tree trunks and fruits were monitored with linear variable displacement transducers. In 1968, the effects of treatments on water use were small and inconclusive. The white reflective treatment reduced water use by tomatoes by 10%, but reduced yields by 30% in 1969. Evaporative cooling increased yields of tomatoes in 1968 and 1969. In 1968, evaporative cooling increased total citrus yields and increased the tonnage of fruits which could be sold to fresh market. Evaporative cooling was effective in influencing fruit quality and size, and offers the promises of increasing the yield of quality produce and of making more efficient use of water. (Knapp-USGS)
W70-09830

A SIMPLE ENERGY BALANCE APPROACH TO THE MOISTURE BALANCE CLIMATOLOGY OF AFRICA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography; and King's Coll., London (England). Dept. of Geography.
J. A. Davies, and P. J. Robinson.
In Environment and Land Use in Africa, Thomas, M. F. and Whittington, G. W. (Eds), Chapter 3, p 23-56, Methuen and Company, London, 1969. 33 fig, 4 tab, 42 ref.

Descriptors: *Climatic data, *Solar radiation, *Precipitation (Atmospheric), *Evapotranspiration, *Convection, Evaporation, Ecology, Latent heat, Advection, Climatic data, Climatic zones.
Identifiers: *Potential water loss, *Africa, *Oasis effect, *Nigeria, *Bowen ratio, Net radiation, Climatic stations, Pans, Heating coefficient, Forest-savannah boundary.

Starting with the assumption that the ecologically significant climatic parameters are energy and moisture balances, the two are linked in theoretical and empirical equations so that measurements of one will have predictive value for the other. Net radiation (RN) at the Earth's surface is approximately equal to evaporation and sensible heat flux. Potential evapotranspiration (PE) then equals RN divided by the latent heat of vaporization of water. The potential water loss (ER) is the difference between rainfall (P) and PE in a given year, flecting either a water surplus or deficit with respect to a given crop and therefore predicting needed irrigation water. Inaccuracies may occur when the oasis effect due to advection is present. Regional weather stations and other data in Nigeria on solar and long-wave radiation facilitated the development of an empirical equation for ER. Sets of plus or minus values of P-ER were plotted against latitude. It was found that P-ER = O at forest-savannah boundaries, suggesting a rational climatic explanation for the existance of these boundaries, contrary to current ecological opinion. ER and P-ER maps are given for each month in Africa over areas from which radiation data are available. (Casey-Arizona)
W70-09962

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
W. L. Ehrler.
In: Physiological Systems in Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 239-247, University of New Mexico Press, 1969.

Descriptors: *Stomata, *Evapotranspiration, Plant growth, Xerophytes, Corn (Field), Water vapor, Carbon dioxide.
Identifiers: *Leaf temperatures, *Assimilation, *Leaf diffusion resistance, *Water-use efficiency, *Transpiration ratios, Mesophytes, Agave, Succulents.

In greenhouse experiments with irrigated, growing corn and agave, transpiration, leaf temperatures, and leaf diffusion resistances were measured. Daytime leaf temperatures in corn were 1-2 degrees above room temperature whileagave leaf temperatures were 8-9 degrees higher. At night corn leaves were the same as, and agave leaves slightly lower than room temperature, indicating some evaporative cooling in agave. Expressed as percentage of daylight value, dark transpiration rates were 7 percent for corn and 200 percent for agave. Leaf diffusion resistances were completely out of phase, being high in the light for agave and high in the dark for corn. Both transpiration rates and leaf diffusion resistances showed that contrary to most plants, stomatal opening in agave is uninfluenced by light and largely occurs in the dark. Mean transpiration ratios were 136.0 for corn and 70.5 for agave. Dry weight gains were about equal in the 2 species indicating that water use efficiency of agave is about twice that of corn, illustrating a general quality of succulents. (Casey-Arizona)
W70-09964

2E. Streamflow and Runoff

FLOOD OF JULY 22, 1969 IN THE NORTHERN VIRGINIA AREA,
Geological Survey, Richmond, Va.
E. M. Miller, and F. P. Kapinos.
US Geological Survey Open-file report, 1970. 35 p, 21 fig, 1 plate, 3 tab.

Descriptors: *Storm runoff, Floods, *Rainfall-runoff relationships, *Virginia, *Historic flood, Runoff, Streamflow, Rainfall, Precipitation (Atmospheric), Stream gages, Data collections, Hydrologic data, Urbanization, Cities.
Identifiers: *Arlington (Va), Alexandria (Va), Fairfax County (Va).

Heavy rainfall during a thunderstorm on the night of July 22, 1969, produced record flooding in parts of the Washington metropolitan area. Runoff was the highest for the period of record at gaging sites in the Virginia suburbs. There was no loss of life, but hundreds of stores, homes, and apartment buildings were flooded, principally by Fourmile Run. Peak stages and discharges are given for 15 gaging stations and 6 miscellaneous sites. (Knapp-USGS)
W70-09530

SCALE EFFECTS IN THE PHYSICAL MODELING OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-09538

THE RELATIONS OF HYDROLOGY AND GEOMORPHOLOGY IN A HUMID TROPICAL STREAM BASIN - THE RIO GRANDE DE MANATI, PUERTO RICO,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
Lawrence A. Lewis.
Available from NTIS as AD-679 462, $3.00 in paper copy, $0.65 in microfiche. Final Report of National Research Council, Division of Earth Sciences, 1968. 130 p, 28 fig, 5 tab, 31 ref. ONR Contract N00014-67-0244-0001.

Descriptors: *Geomorphology, *Tropical regions, *Rainfall-runoff relationships, *Puerto Rico, Wet climates, Hydrogeology, Hydrographs, Stage-discharge relations, Hydraulics, Open channel flow, Sediment transport, Channel morphology, Duration curves, Drainage patterns (Geologic).
Identifiers: Rio Grande de Manati (Puerto Rico).

This study analyzes the manner in which the channel of the Rio Grande de Manati, located in north-central Puerto Rico, changes in cross section in both the downstream direction from its source waters to its mouth and at seven individual sites along the river. The basic parameters which were measured include the stream's width, depth, velocity, bed material size, and size of drainage area. The kinds of bedrock over which the streams flow and the nature of the river bank materials were noted. These measurements were made to determine what changes occur in individual river reaches as flow conditions vary; to resolve how the variables of width, depth, and velocity change in the downstream direction at a given frequency of discharge; to ascertain what is the hydraulic geometry of the Rio Grande de Manati; and to see if the concept of dynamic equalibrium is valid in a humid tropical stream basin. (Knapp-USGS)
W70-09566

DERIVING THE UNITGRAPH WITHOUT USING RAINFALL DATA,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
R. J. De Laine.
Journal of Hydrology, Vol 10, No 4, p 379-390, June 1970. 12 p, 2 fig, 6 tab.

Descriptors: *Unit hydrographs, *Runoff forecasting, *Rainfall-runoff relationships, Hydrograph analysis, Routing, Linear programming, Synthetic hydrology, Simulation analysis, Hydrographs, Mathematical studies.
Identifiers: Hydrograph synthesis.

The characteristic of a linear time invariant system can be found uniquely from any two outputs that have no error; it is not necessary to know the inputs or the time duration of the system response. In hydrologic terms, the unitgraph of a catchment with linear characteristics may be found from records of runoff vs time. (Knapp-USGS)
W70-09680

BOTTOM CURRENTS NEAR THE COAST DURING HURRICANE CAMILLE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Stephen P. Murray.
Journal of Geophysical Research, Vol 75, No 24, p 4579-4582, August 20, 1970. 4 p, 3 fig, 15 ref. ONR Contract Nonr 1575 (03) and NR 388-002.

Descriptors: *Currents (Water), *Ocean currents, *Hurricanes, *Current meters, *Florida, Winds, Rip currents, Ocean waves, Waves (Water), Coasts, Storms.
Identifiers: Hurricane Camille (1969).

A ducted current meter, which was mounted on the bottom in 6.3 meters of water off the coast of the Florida panhandle, was operative during much of the activity of Hurricane Camille. Before the arrival of the storm an unexpected outward extension of the wave-driven longshore current was recorded. During the storm bottom current speeds ranged up to 160 cm/sec., and their direction rotated from alongshore parallel to the wind to seaward against the wind. (Knapp-USGS)
W70-09685

TRAVELING CORRELATION FUNCTION OF THE HEIGHTS OF WIND-BLOWN WATER WAVES,
Naval Postgraduate School, Monterey, Calif. Dept of Physics; and Wisconsin Univ., Middletown. Geophysical and Polar Research Center.
H. Medwin, C. S. Clay, J. M. Berkson, and D. L. Jaggard.
Journal of Geophysical Research, Vol 75, No 24, p 4519-4524, August 20, 1970. 6 p, 5 fig, 1 tab, 23 ref.

Descriptors: *Waves (Water), *Model studies, Hydraulic models, Mathematical models, Ocean waves, Winds, Mathematical studies, Statistical models, Correlation analysis.
Identifiers: Wave tanks.

A wind-blown water surface can be characterized in terms of a traveling correlation function in which the group and phase velocities are given by the values at the frequency of maximum spectral energy density. The two-dimensional (space and time) surface displacement correlation function has been measured for low-divergence wind-blown waves in a laboratory tank. The measured phase and group velocities of the correlation function agreed with theoretical values for the peak frequency water-wave component when the measurements were transformed to coordinates that had the velocity of the surface (drift) current. This description, which may be useful in the ocean as well, has recently been used to predict the temporal correlation of sound scattered from a model sea of known three-dimensional surface correlation function. (Knapp-USGS)
W70-09689

FLOODS OF DECEMBER 1966 IN SOUTHWESTERN UTAH,
Geological Survey, Washington, D.C.
Elmer Butler, and J. C. Mundorff.
For sale by Superintendent of Documents, US Government Printing Office, Wash, D C. 20402. U S Geological Survey Water-Supply Paper 1870-A, 1970. 40 p, 12 fig, 2 plate, 6 tab, 8 ref.

Descriptors: *Floods, *Utah, *Stage-discharge relations, Water levels, Discharge (Water), Historic flood, Hydrologic data, Data collections, Sediment load, Silting, Soil erosion, Flood damage, Suspended load, Bed load.
Identifiers: Virgin River (Utah).

Severe floods occurred in parts of southwestern Utah on Dec. 5-6, 1966, as a result of precipitation of about 1 inch to more than 12 inches during Dec. 3-6. The flood on the Virgin River was the greatest since the first settlers arrived in 1860. The peak discharge of the Virgin River at Virgin, Utah, was 22,800 cubic feet per second on Dec. 6; this exceeded the previous maximum discharge of 13,500 cubic feet per second on March 3, 1938, and Sept. 17, 1961, and probably has a recurrence interval of 100 years. The suspended-sediment discharge during the period Dec. 5-8, 1966, at Santa Clara River above Winsor Dam, near Santa Clara was about four times greater than all the suspended-sediment discharge during the preceding 3 years; the suspended-sediment discharge of the Virgin River at Virgin was greater during the 4-day period than during any one of the preceding 3 years. Total damage in the Dixie Soil Conservation District in Washington County was about $835,000; 60% of the damage was caused by floodwater and 40% by deposited sediment. (Knapp-USGS)
W70-09701

SUMMARY OF FLOODS IN THE UNITED STATES DURING 1964,
Geological Survey, Washington, D.C.
J. O. Rostvedt.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C. 20402 - Price $0.60. US Geological Survey Water-Supply Paper 1840-C, 1970. 124 p, 58 fig, 29 tab, 21 ref.

Descriptors: *Floods, *United States, *Historic flood, Flood damage, Hurricanes, Rainfall, Rainfall-runoff relationships, Stage-discharge relations, Water levels, Discharge (Water), Runoff, Streamflow, Data collections, Hydrologic data.
Identifiers: U. S. Floods (1964).

This report describes the most outstanding floods in the United States during 1964. The four most damaging floods during the year were in December in the Far Western States, in March along the Ohio River, in September in central and northern Florida and southern Georgia, and in June in northwestern Montana. The floods of December in the Far Western States were the most damaging in the history of the area. Record-breaking discharges occurred in an unusually large area--Oregon, northern California, western Nevada and Idaho, and southern Washington. Two storms in early March along the Ohio River caused maximum discharges of record on many streams in Ohio, Kentucky, and Indiana and also high discharges in part of Illinois, West Virginia, and Pennsylvania. In September, Hurricane Dora, the first hurricane of record to cross northeastern Florida from the Atlantic Ocean, caused outstanding floods in northern Florida and southern Georgia. The most severe floods of record in northwestern Montana occurred on both sides of the Continental Divide following heavy rains in early June. In addition to the floods mentioned above, 21 others of lesser magnitude are listed. (Knapp-USGS)
W70-09703

INFILTRATION AS A FACTOR AFFECTING RUNOFF COMPUTATIONS,
Prague Agricultural Univ. (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09723

ON THE THEORY OF LONGITUDINAL DISPERSION,
Hydronautics, Inc., Laurel, Md.
C. Elata.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1 - Microturbulent Diffusion and Dispersion), Paper D1, p 1-10, 1967. 10 p, 4 fig, 6 ref.

Descriptors: *Turbulent flow, *Dispersion, *Open channel flow, Mixing, Hydraulic radius, Turbulence, Roughness (Hydraulic), Reynolds number, Diffusion, Path of pollutants, Tracers, Tracking techniques, Mathematical studies, Streamflow.
Identifiers: Longitudinal dispersion.

A tracer injected in a uniform turbulent stream will, after a long period attain a Gaussian average-concentration distribution. A simplified conservation of mass equation, applicable to this condition, is written in orthogonal curvolinear coordinates in such a way that one of the coordinates coincides with the isovels of the stream. A general expression for the dispersion coefficient is derived, depending on the shear velocity, the hydraulic radius, the basic velocity profile and the metric coefficients of the coordinate system. This approach allows the numerical calculation of dispersion coefficients in streams in which velocities vary in the transverse as well as in the vertical direction, without a need for any additional assumptions concerning the dispersivity. Some simple calculations show that the non-dimensionalized dispersion coefficient varies only slightly with Reynolds number and boundary roughness. In elliptical channels, with various width to depth ratios, the dispersion coefficients depend heavily on the shape of the isovels. (Knapp-USGS)
W70-09734

ANALYTIC PREDICTION OF LONGITUDINAL DISPERSION COEFFICIENTS IN NATURAL STREAMS,
California Univ., Berkeley. Dept. of Civil Engineering.
Hugo B. Fisher.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D2, p 11-19, 1967. 9 p, 2 fig, 3 tab, 6 ref.

Descriptors: *Dispersion, *Turbulent flow, *Open channel flow, Alluvial channels, Mixing, Turbulence, Roughness (Hydraulic), Diffusion, Path of pollutants, Mathematical studies, Model studies, Mathematical models, Hydraulic models.
Identifiers: Longitudinal dispersion.

Field measurements of the longitudinal dispersion coefficient in natural streams have produced coefficients far greater than was expected from the analytic work of Taylor and Elder. The dispersive effect of the vertical gradient of downstream velocity, on which Elder's analysis was based, is overwhelmed by the far greater dispersive effect of horizontal (transverse) gradients. A method is given for predicting the dispersion coefficient of any natural stream, based on measurements of lateral velocity variations. To use the method field measurement is required of channel-sectional geometry, cross-sectional distribution of velocity, and slope. For most channels these measurements are either already available or may be easily obtained. The method has been proven accurate by a comprehensive series of laboratory experiments, and by experiments in one natural stream. (Knapp-USGS)
W70-09735

TRACER STUDIES ON TURBULENT DIFFUSION AND DISPERSION,
Chalmers Univ. of Technology, Goteborg (Sweden).
For primary bibliographic entry see Field 08B.
W70-09736

DIFFUSION OF WARM WATER JETS DISCHARGED HORIZONTALLY AT THE WATER SURFACE,
Chuo Univ., Tokyo (Japan). Hydraulic Lab.
Taizo Hayashi, and Nobuo Shuto.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D6, p 47-59, 1967. 13 p, 14 fig, 2 photo, 5 tab, 6 ref.

Descriptors: *Diffusion, *Mixing, *Jets, *Heated water, Open channel flow, Flow, Turbulent flow, Convection, Dispersion, Model studies, Hydraulic models.
Identifiers: Jet diffusion.

Several experiments were made on the diffusion of warm water jets discharged horizontally at the surface of initially quiescent water. The temperature was from 0.2 deg to 28 deg higher than the receiving water, the densimetric Froude numbers of the jets at an outlet varied from 16.1 to 1.4, and the Richardson numbers of the jets at the outlet varied from 0.00 to 0.54. An approximate theory was developed with the assumptions that: (1) The horizontal diffusion terms in the equation of motion equal the horizontal pressure gradient term; (2) the profiles of temperature in vertical sections are of similar form and the profiles of horizontal velocity in vertical sections are also of similar form; (3) the rate of entrainment at the bottom of the surface layer of warm water is proportional to some characteristic velocity at that vertical plane; (4) the turbulent-diffusion coefficients are constants. The experimental results were compared with the approximate theory, and the effect of Richardson number on the diffusion of warm water jet is discussed. (Knapp-USGS)
W70-09738

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
Akira Murota, and Kouji Muraoka.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D7, p 60-70, 1967. 11 p, 10 fig, 12 ref.

Descriptors: *Jets, *Mixing, *Dispersion, Diffusion, Turbulence, Turbulent flow, Velocity, Bubbles, Saline water intrusion, Estuaries, Water pollution control.
Identifiers: Vertical jets.

A water-curtain formed in a stream by a series of vertical jets from bottom to surface may be used as a barrier for the control of salinity intrusion in tidal reaches of rivers. Mixing of free jets in unbounded space is analyzed for cases of two and three dimensional jets. When the still water depth is larger than 20 times the representative length of injection nozzles, velocity decreasing along the jet axis is quite similar to that of free jets except in a stagnant region. Distributions of vertical velocity in the mixing region are given by Tollmien's theory. The proportional constant for vertical jets is about 3 times larger than that of free jets; thus nominal boundaries of vertical jets are more widely spread than those of free jets. (Knapp-USGS)
W70-09739

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 02A.
W70-09831

HYDROLOGY OF WATER YIELD PREDICTION: METHODOLOGY FOR WATERSHED LOW-FLOW PREDICTION,
Oregon State Univ., Corvallis. Water Resources Research Inst.
John C. Campbell.
Available from the NTIS as PB-194 240, $3.00 in paper copy, $0.65 in microfiche. Oregon State University Water Resources Research Institute Project Completion Report, June 1970. 68 p, 7 fig, 11 tab, append. Project A-001-OREG.

Descriptors: *Low flow, *Streamflow forecasting, *Oregon, *Small watersheds, Probability, Rainfall-runoff relationships, Precipitation (Atmospheric), Frequency analysis.
Identifiers: Low-flow prediction.

Methodology was developed for prediction of low flow for small watersheds. Ten years of precipitation data were collected, adjusted, and analyzed for Deer Creek, Flynn Creek, and Needle Branch, Oregon. There was no really significant correlation between seasonal low-flow quantity and precipitation quantities for any previous period of time. A probability graph, based upon related previous discharge records, proved capable of predicting low-flow watershed yields normally within a 10% error. High-elevation reservoir systems for water storage can be utilized to retain 25 to 100% of annual water yield for later release, producing virtually uniform streamflow. (Knapp-USGS)
W70-09832

LINEAR-MOMENTUM FLUX TO OVERBANK SECTIONS,
Geological Survey, Atlanta, Ga.; and Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 08B.
W70-09837

WATER WAVES GENERATED BY LANDSLIDES IN RESERVOIRS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02H.
W70-09839

SOME STATISTICAL PROPERTIES OF DENDRITIC CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
W. C. Krumbein, and Ronald L. Shreve.
Report available from NTIS as AD-705 625, $3.00 in paper copy, $0.65 in microfiche. Northwestern University, Department of Geological Sciences Technical Report No 13, April 1970. 118 p, 32 ref. ONR Contract 389-150 (Formerly 388-078).

Descriptors: *Geomorphology, *Drainage patterns (Geologic), *Drainage density, *Statistical models, *Topography, Geology, Structural geology, Statistical methods, Correlation analysis, Regression analysis, Joints (Geology), Erosion, Stream erosion.
Identifiers: Stream order, Drainage basin analysis, Topology.

Quantitative geomorphic measurements were made on modern 1:24,000-scale topographic maps for 90 order-3 and 90 magnitude-10 basins randomly selected from a 250 square-mile area of horizontal, homogeneous sandstones in eastern Kentucky. Operator variations were greatest in locating sources and least in measuring areas, and were readily reduced to acceptable limits by training and practice. Distributions of drainage density, relief, and outlet elevation are essentially the same in the two samples, whereas those of area, total channel length, and a shape measure are significantly narrower in the magnitude-10 sample. Simple and multiple linear correlation, and trend surface, factor, and discriminant function analyses were made to illuminate the differences between the samples, and hence between order and magnitude as the basis for classifying drainage-basin data. Similar measurements were made on 153 magnitude-5 basins in the study area. Cis and trans links have nearly equal probabilities but strongly differing length distributions. Link lengths do not vary significantly up to magnitude 1311. Total stream length and basin area are highly correlated, with a trend that supports the hypothesis that the areas draining into the sides of links ought to vary quadratically with link length in the smallest basins and directly with it in the largest. (Knapp-USGS)
W70-09843

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1963,
Agricultural Research Service, Washington, D.C. Soil and Water Research Div.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $4.00. Harold W. Hobbs and James B. Burford, Compilers. US Department of Agriculture Research Service Miscellaneous Publication No 1164, July 1970. 465 p, 4 tab.

Descriptors: *Hydrologic data, *Agricultural watersheds, United States, Data collections, Research and development, Watersheds (Basins), Precipitation (Atmospheric), Runoff, Air temperature, Documentation, Planning, Storm runoff, Hydrographs, Hydrologic aspects.
Identifiers: *Agricultural experiment stations.

Selected hydrologic data are presented for calendar year 1963. Included are monthly precipitation and runoff records for 168 watersheds, annual maximum discharges and volumes of runoff for 156 of the basins for time intervals of 1, 2, 6, and 12 hours and for 1, 2, and 8 days, daily precipitation and discharge and or daily air temperature on 57 watersheds and detailed data for one or more selected typical storm events for 142 watersheds. Decimal page numbering used is consistent with that used in the five previous publications, so that previous records and general descriptions can be readily consulted. State agricultural experiment stations collaborated in selecting, planning, and operation of the studies, and the U.S. Geological Survey and State and local agencies assisted in the work. (Lang-USGS)
W70-09851

DIFFUSION OF SUBMERGED SLUICE GATE FLOW OVER A DROP,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09856

MATHEMATICAL MODELING OF DISPERSION IN RIVERS,
Vanderbilt Univ., Nashville, Tenn. School of Engineering.
Karl B. Schnelle, Jr., Edward L. Thackston, and Peter A. Krenkel.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D4, p 33-41, 1967. 9 p, 3 fig, 8 ref.

Descriptors: *Dispersion, *Streamflow, *Turbulent flow, Turbulence, Mathematical studies, Mixing, Sediment transport, Equations, Model studies, Open channel flow.
Identifiers: Longitudinal mixing.

Dispersion in turbulent streams is described by dividing the flow into a main stream and dead zone. Two coupled partial differential equations are written as a model of the dispersion. This dead zone model is shown to improve the statistical fit of experimental concentration-time data when compared to Taylor's dispersion model. An equation is suggested to predict the dispersion coefficient in natural streams if in short uniform reaches the dead zone model is used to describe the dispersion. (Knapp-USGS)
W70-09858

HYDRAULIC MODEL EXPERIMENT ON THE DIFFUSION DUE TO THE TIDAL CURRENT,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02L.
W70-09859

MARKOV CHAIN MODELS OF TURBULENT DIFFUSION,
Cambridge Univ. (England). Cavendish Lab.
C. A. Greated.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D10, p 89-96, 1967. 8 p, 6 fig.

Descriptors: *Diffusion, *Markov processes, *Mathematical models, *Computer programs, Turbulent flow, Dispersion, Dye releases, Tracking techniques, Tracers, Probability, Open channel flow.
Identifiers: Turbulent diffusion.

A finite Markov Chain model is described for turbulent diffusion. The model makes it possible to solve problems with complex boundary conditions in a very simple way on a computer. Details are given of the method of solution for three-dimensional diffusion in homogeneous isotropic turbulence. The computations were carried through for a problem on the two-dimensional diffusion of a cloud. (Knapp-USGS)
W70-09860

EFFECT OF PARTICLE SIZES TO TURBULENT DIFFUSIVE PROCESSES IN FREE SURFACE FLOW,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
Yoshiaki Iwasa, and Hirotake Imamoto.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D11, p 97-106, 1967. 10 p, 7 fig, 1 ref.

Descriptors: *Dispersion, *Particle size, *Sediment transport, *Turbulent flow, *Mathematical models, Model studies, Turbulence, Open channel flow, Velocity, Hydraulic models.
Identifiers: Japan.

Mass transport phenomena in a turbulent flow field are physical interactions between the turbulent characteristics of the flow itself and the covective movement of particles transported, so that the diffusive process estimated through the observations of particle dispersions must be influenced by the physical properties of particles used as a tracer. The hydrodynamic effect of particle sizes on the turbulent diffusive process of free surface flow are analyzed by the use of a model obtained under the assumption that the instantaneous velocity of a particle is a volumetric mean value of the fluid velocities. Some observations in turbulent free surface flow are also provided to compare with the mathematical analysis. (Knapp-USGS)
W70-09861

EXPERIMENTAL RESULTS OF DYE DIFFUSION IN LARGE PIPELINES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09863

RADIAL DIFFUSION IN TURBULENT PIPE FLOW,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08B.
W70-09864

TURBULENT DIFFUSION IN THE HYDRAULIC JUMP,
Technische Hochschule, Karlsruhe (West Germany).
Max Breitenoder, and Heinrich Dorer.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D15, p 137-145, 1967. 9 p, 9 fig, 3 ref.

Descriptors: *Hydraulic jump, *Diffusion, *Turbulent flow, Turbulence, Tracers, Saline water, Model studies, Laboratory tests, Hydraulic models, Stage-discharge relations, Mixing, Vortices, Turbulence, Open channel flow.
Identifiers: Turbulent diffusion.

To permit studies of the turbulent diffusion in hydraulic jump, concentration tests were made with a salt solution used as tracer. The concentration was measured by electric conductivity tests, made directly in the flow. The tests, carried out for Froude numbers 2 to 7, showed that the degree of irregularity of the distribution of mean concentration is dependent on the Froude number. Perfect mixing (degree of irregularity equal to zero) shifts towards the starting point of the hydraulic jump with increasing Froude-numbers. (Knapp-USGS)
W70-09865

STOCHASTIC SIMULATION OF THE DIFFUSION OF JETS,
Carnegie Inst. of Tech., Pittsburgh, Pa.
For primary bibliographic entry see Field 08B.
W70-09866

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
T. Dincer.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/8, p 93-113, 1967. 21 p, 2 fig, 12 ref.

Descriptors: *Tracers, *Radioisotopes, *Tracking techniques, *Streamflow, *Discharge measurement, Stream gages, Water measurements, Discharge (Water), Mixing, Stage-discharge relations, Tritium, Sampling, Safety, Adsorption, Water chemistry.
Identifiers: Streamflow measurement.

An attempt is made to evaluate methods using radiotracers in streamflow measurements. The basic principles of the tracer method are explained and background information given. Radiotracers used in stream discharge measurements are discussed and measurements made by different research workers are described. Problems such as adsorption of the tracer and the mixing length are discussed and the potential use of the radioisotopes as tracer in the routine stream-gaging work is evaluated. It is concluded that, at the present stage of development, radiotracer methods do not seem to be ready for routine use in stream-gaging work, and can only be used in some special cases. For gamma-emitting radioisotopes there are problems related to safety, transport and injection which should be solved. Tritium, though a very attractive tracer in some respects, has the disadvantages of having a relatively long half-life and of disturbing the natural tritium levels in the region. An attempt is made to define the objectives of the research in the field of application of radioisotopes in hydrometry. (See also W70-09868) (Knapp-USGS)
W70-09874

TRANSFORMATION OF RIVER WATER AT THE MOUTH OF A RIVER AND SOME CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02K.
W70-09946

THE DRY SEASON FLOW CHARACTERISTICS OF WEST AFRICAN RIVERS,
Edinburgh Univ. (Scotland). Dept. of Forestry and Natural Resources.
D. C. Ledger.
In Environment and Land Use in Africa, Thomas, M. F. and Whittington, G. W. (editors), Chapter 5, p 82-102, Methuen, London, 1969. 8 fig, 2 tab, 9 ref.

Descriptors: *Dry seasons, *Rainfall, *River flow, *River systems, *Surface runoff, Tropical regions, Arid lands, Groundwater recharge, Floodplains.
Identifiers: *West Africa, *Intertropical convergence zone, *Niger River.

The climate of West Africa is controlled by seasonal migration of the intertropical convergence zone between 9-20 degrees north. Rainfall in maritime regions is zonal and decreases inland with latitude. An east-west geological boundary exists at 12 degrees north. The southern region consists of highland blocks while the northern region comprises vast depositional plains. Streamflow is influenced by drainage basin size. In small basins direct run-off passes the outlet point quickly and dry season flow ceases unless groundwater discharge occurs. Large rivers have similar dry season over-all flow patterns but take much longer to recede from high wet season to low dry season flow. In the rivers with large floodplains, water storage in shallow lakes during high periods and water release during low periods combine with phasic differences in wet and dry periods over widely separated parts of their courses creating compensatory effects resulting in less variable year-round flow. The Niger River is an outstanding example and flow is analyzed over its entire course. (Casey-Arizona)
W70-09963

2F. Groundwater

GROUNDWATER IN KEARNY COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Garden City, Kans.
E. E. Gutentag, D. H. Lobmeyer, and H. E. McGovern.
U S Geological Survey Open-file report, 1970. 40 p, 18 fig, 4 tab, 7 ref.

Descriptors: *Hydrogeology, *Aquifers, *Kansas, Hydrologic data, Water resources, Water resources development, Data collections, Irrigation water, Water wells, Sandstones, Alluvium, Water level fluctuations, Geology.
Identifiers: Kearny County (Kans.).

Groundwater may be developed in Kearny County, Kansas, from Jurassic and Cretaceous sandstones and from Tertiary and Quaternary alluvium. The Upper Jurassic rocks consist of a fine-grained silty sandstone unit overlain by a variegated shale and dark-gray sandy shale unit. The Lower Cretaceous rocks consist of the Cheyenne Sandstone (a fine-to medium-grained sandstone interbedded with shale), the Kiowa Shale (predominantly shale interbedded with thin sandstone layers), and the Dakota Formation (a fine- to medium-grained sandstone interbedded with sandy shale and shale). The thickness of the sandstone aquifer ranges from about 350 to 500 feet. Because the aquifer includes numerous beds of shale and sandy shale and because the sandstone beds commonly are silty or tightly cemented, the yield of groundwater to wells may be sufficient only for domestic or stock supplies. The Tertiary and Quaternary deposits are hydrologically connected and are considered as one aquifer. Because these deposits consist of alternating lenses of fine- and coarse-grained alluvial sediments, groundwater movement is retarded vertically and laterally. Thus, the water-yielding capacity of the aquifer differs from one area to another, and the water may be semiconfined (semiartesian) or unconfined. The increasing use of groundwater for irrigation has resulted in a decline in water levels and a gradual loss of water in storage. (Knapp-USGS)
W70-09544

GROUNDWATER RESOURCE EVALUATION,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
William C. Walton.
New York, N.Y., McGraw-Hill Book Company, 1970. 664 p.

Descriptors: *Groundwater, *Groundwater movement, *Hydrology, *Hydrogeology, *Water resources development, Aquifers, Water wells, Water yield, Water storage, Surveys, Investigations, Hydraulics, Hydrodynamics, Unsteady flow, Systems analysis, Mathematical models, Analog models, Water management (Applied), Water quality.
Identifiers: Aquifer testing, Pumping tests.

A textbook presents both the basic principles of groundwater resource evaluation and the practical application of techniques to well and aquifer problems. Derivation of equations as well as numerous illustrative case histories of analyses based on actual field data are presented. Numerous practical problems which may be solved with available equations, and methods of analysis are given. A comprehensive bibliography is presented containing references to the literature germane to groundwater resource evaluation. Equations and analytical methods most frequently applied to actual groundwater resource evaluation field problems are presented. They include equations and methods used to quantitatively appraise the hydrogeologic parameters affecting the water-yielding capacity of wells and aquifers, and equations and methods used to quantitatively appraise the response of wells and aquifers to heavy pumping. This book, in addition to serving as a text for groundwater courses, should aid in the systematic appraisal of groundwater resource problems by practicing engineers and geologists. (Knapp-USGS)
W70-09551

OPTIMAL RESOURCE USE OVER TIME WITH AN APPLICATION TO GROUNDWATER,
California Univ., Davis.
Oscar R. Burt.
Management Science, Vol 11, No 1, p 80-93, September 1964. 19 ref, 2 append.

Descriptors: *Time, *Groundwater, Decision making, Resource allocation, Supply, Dynamic programming.
Identifiers: *Optimal resource use, *Resource use, Decision rules, Storage control.

This paper is concerned with optimal allocation over time of a single resource which is either fixed in supply or only partially renewable at a point in time. Some resources which fall in this category are mineral deposits, groundwater, petroleum, wildlife, and fish. A functional equation is obtained from a dynamic programming formulation of the problem. This functional equation is used to derive approximate decision rules for resource use as a function of current supply. The results are applied to groundwater storage control and tested empirically by comparison with a decision rule obtained by detailed numerical methods. (Loeb-Rutgers)
W70-09649

ANALYSIS OF DATA FROM PUMPING TESTS IN UNCONFINED ANISOTROPIC AQUIFERS,
Norman S. Boulton.
Journal of Hydrology, Vol 10, No 4, p 369-378, June 1970. 10 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Groundwater movement, *Transmissivity, *Data processing, Hydrologic data, Permeability, Steady flow, Unsteady flow, Drawdown, Water levels, Water table, Water Storage, Storage coefficient, Aquifers, Water level fluctuations, Water yield.
Identifiers: Pumping tests, Aquifer tests.

The errors involved in finding the coefficients of transmissibility and storage using pumping-test data are briefly discussed. Distance-drawdown data are advocated as generally most suitable for finding the transmissibility. Procedures are based on distance-drawdown analysis with constant storage coefficient and time-drawdown analysis with delayed yield from storage. Anomalies which result from well-known methods of analysis are illustrated by pumping test data. The methods described assume a fully-penetrating pumped well and shallow observation wells, except in the case of a very deep aquifer. A computer is not required. An exact equation, allowing for the vertical velocity-component of the flow and delayed yield from storage, is given. (Knapp-USGS)
W70-09681

SUMMARY RECORDS OF SUPPLY WELLS AND TEST WELLS IN THE POST HEADQUARTERS AREA, WHITE SANDS MISSILE RANGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
James B. Cooper.
U S Geological Survey Open-file report, July 1970. 202 p, 87 fig, 74 tab, 9 ref.

Descriptors: *Groundwater, *Water resources development, *Surveys, *New Mexico, Water wells, Aquifers, Alluvium, Water levels, Water quality, Water yield, Sampling.
Identifiers: White Sands Missile Range (N Mex).

Data that have been collected from the drilling, construction, testing, water sampling, and water-level measurement of all supply and test wells in the Post Headquarters area, White Sands, Missile Range, are summarized. The area of the Post Headquarters is in a reentrant between the Organ Mountains on the south and west and the San Augustin and San Andres Mountains on the north; it merges with the Tularosa Basin on the east. The total relief of the area is nearly 5,000 feet. The reentrant is underlain by unconsolidated or semiconsolidated bolson deposits consisting of alternating layers of clay and sand and some gravel. The thickness of the bolson deposits has not been well established by test drilling; however, geophysical exploration indicate that it ranges from 250 feet near the mountains to 4,000 feet along the eastern edge of the reentrant. Farther to the east in the basin proper, bolson deposits exceed 6,000 feet in thickness. The depth to water ranges from about 50 to more than 400 feet. The chemical quality of water within the reentrant is good. The shallow water farther east in the Tualrosa Basin is highly saline. Summary records of supply wells, diagrams showing the construction and lithology of individual supply wells, chemical analyses of water samples collected from the supply wells, graphs showing the annual pumpage from each supply well, and hydrographs of the supply wells are tabulated. Summary records of test wells, diagrams showing the construction and lithology of individual tests wells, chemical analyses of water samples collected from the test wells, and hydrographs of the test wells are also presented. (Knapp-USGS)
W70-09684

ANALYSIS OF A RECONNAISSANCE GRAVITY SURVEY FOR DRIFT-FILLED VALLEYS IN THE MERCER QUADRANGLE, PENNSYLVANIA,
Naval Oceanographic Office, Washington, D.C. Magnetics Div.; and Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
William E. Rankin, and Peter M. Lavin.
Journal of Hydrology, Vol 10, No 4, p 418-435, June 1970. 18 p, 6 fig, 17 ref.

Descriptors: *Gravity studies, *Surveys, *Alluvial channels, *Aquifers, *Pennsylvania, Water resources development, Sands, Gravels, Glacial drift, Seismic studies, Statistical methods, Geophysics, Analytical techniques, Hydrogeology.
Identifiers: Mercer (Penn).

The effectiveness of a standard polynomial trend removal technique and two-dimensional wavenumber biltering in isolating gravity anomalies due to buried preglacial drainage systems was evaluated for an area in northwestern Pennsylvania. It was found that gravity surveying is a useful reconnaissance technique in this area. Both analytical methods isolated anomalies due to valleys of major hydrological interest, provided similar useful information on the valley trends, and gave reasonably accurate width estimates. Accurate depth estimates could not be inferred, although large anomalies generally coincided with thicker drift accumulations. With the station spacing used (about 0.75 miles), valleys sought must have drift accumulations in excess of 75 feet and widths of at least one mile if they are to be adequately resolved. The two-dimensional filtering method seems to offer the most complete information, while still being practical, and it avoids many of the problems of the polynomial method. (Knapp-USGS)
W70-09686

EVALUATION OF SELECTED COBALT-60 COMPLEXES AS TRACERS OF GROUNDWATER,
Northeast Louisiana State Coll., Monroe. Dept. of Chemistry; and Agricultural Research Service, Oxford, Miss.
For primary bibliographic entry see Field 07B.
W70-09691

MISSOURI - LAND OF WATER,
Stephen C. Casteel.
Water and Sewage Works, Vol 117, No 8, p 284-287, August 1970. 4 p, 1 tab, 3 ref.

Descriptors: *Springs, *Missouri, Water yield, Discharge (Water), Water utilization, Streamflow, Karst, Limestones, Groundwater movement.
Identifiers: Missouri springs.

The Big Spring country of Missouri has an unusual density and size of springs within a relatively small area. The discussion includes 47 springs in Missouri having a total outflow of 1.346 bgd, and one in Arkansas with a total of 864 mgd. There are more than 500 known springs in Missouri. (Knapp-USGS)
W70-09695

A GLOSSARY OF KARST TERMINOLOGY,
Geological Survey, Washington, D.C.
Watson H. Monroe.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C. 20402 - Price $0.25. U S Geological Survey Water-Supply Paper 1899-K, 1970. 26 p, 11 ref.

Descriptors: *Karst, *Geomorphology, Groundwater movement, Hydrogeology, Publications, Technical writing.
Identifiers: Glossary (Karst terminology).

This glossary includes most terms used in describing karst geomorphologic features and processes. The terms are primarily those used in the literature of English-speaking countries, but a few of the more common terms in French, German, and Spanish are included, with references to the corresponding English terms where they are available. The glossary also includes simple definitions of the more common rocks and minerals found in karst terrain, common terms of hydrology, and a number of the descriptive terms used by speleologists. The glossary does not include definitions of most biospeleological terms, geologic structure terms, varieties of carbonate rock that require microscopic techniques for identification, or names describing tools and techniques of cave exploration. (Knapp-USGS)
W70-09702

HYDROGEOLOGICAL MAPS OF KOREA - VOL 1, ANSEONG RIVER BASIN, (KOREAN),
Geological Survey of Korea, Seoul.
Jeong Ung Lim, and Chang Ju Cho.
Geological Survey of Korea Hydrogeological Maps, Vol 1, 1969. 48 p, 22 fig, 15 tab, 5 photo, 16 ref.

Descriptors: *Hydrogeology, *Surveys, *Water resources development, Aquifers, Water yield, Alluvium, Water wells, Transmissivity, Permeability.
Identifiers: Korea, Anseong River basin.

Results are presented of hydrogeological studies in the Anseong River basin in the central part of the Korean peninsula. The geology of the area mainly consists of biotite granite, gneiss and mica schist. Sufficient groundwater can be developed from bedrock only from the highly weathered zone and from alluvium. The thickness of the alluvial deposits range up to about 9 meters at the vicinity of Anseong town and 12 meters at the Pyeongtaek area. In order to determine the hydraulic constants in this basin, more than 20 aquifer tests were carried out. The most favorable area of the basin is the inner part of the Pyeongtaek plain. The coefficients of transmissibility are 0.8 to 3.0 sq m/min, and the safe yields are more than 500 cu m perday for every pumping well. The possible total amounts of the groundwater developed could be more than 630,000 cu m per day in years of average annual precipitation and at least 1,100,000 cu m per day in the irrigational season. (Knapp-USGS)
W70-09706

THE KARST LANDSCAPE OF YUCATAN,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
For primary bibliographic entry see Field 02J.
W70-09707

DETERMINATION OF STORAGE COEFFICIENTS FROM OBSERVATION OF GROUNDWATER LEVELS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09708

UNSATURATED SOIL MOISTURE CONDITIONS STUDIED FROM FIELD OBSERVATIONS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09709

EFFECT OF CAPILLARITY ON DISCHARGE OF WATER IN PERMEABLE AQUIFERS CONFINED BY ROCKS WITH SMALL INTERSTICES (FRENCH),
E. Berkaloff.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 909-921, 1968. 13 p, 4 fig, 2 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Capillary fringe, *Water table, Infiltration, Water yield, Saturated flow, Unsaturated flow, Mathematical studies, Percolation.
Identifiers: Capillary fringe movement.

Because the catchment of water in poorly permeable formations is an important problem, water circulation in fine interstitial rocks is discussed. If the effects of capillarity in the calculation of yield are neglected, underestimation results when the capillary fringe is no longer negligible compared to the thickness of the saturated permeable rock. (See also W70-09714 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09713

RELATIONSHIP BETWEEN INFILTRATION AND GROUNDWATER HOUSEHOLD,
National Water Authority, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W70-09719

THE METHOD OF GROUNDWATER RECHARGE EVALUATION IN SAND DESERT BY INVESTIGATION OF MOISTURE EXCHANGE IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09720

THE TYPE SECTIONS OF ROCK MOISTURE IN THE ZONE OF AERATION AND ESTIMATION OF INFILTRATION VALUES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09722

AN ESTIMATION OF MOISTURE DYNAMICS IN THE ZONE OF AERATION AND GROUNDWATER RECHARGE BY THE HEAT-MOISTURE TRANSFER,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
For primary bibliographic entry see Field 02G.
W70-09724

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Toshio Murashita, and Kazuo Kishi.
Bulletin of Geological Survey of Japan, Vol 18, No 6, p 1 (379)-14 (392), June 1967. 14 p, 10 fig, 5 ref.

Descriptors: *Saline water intrusion, *Aquifers, Groundwater movement, Pumping, Withdrawal, Artesian wells, Lava, Sands, Fissures (Geology), Transmissivity.
Identifiers: Japan, Fuji.

In many coastal areas of Japan aquifers have been contaminated with salt water because the seaward flow of groundwater has decreased. The greatest salt-water contamination is in the coastal area along Suruga bay. The contamination first began in the vicinity of Tago-no-ura in 1960, and next on the reaches of Numa River in 1965. The contaminated area in 1966 is ten square kilometers in total. The pumping artesian aquifer is the Fuji lava beds, which has many fissures and caves, and is very permeable. Evidence of the industrial well field indicates that the interface between the fresh water and salt water receded because rainfall was heavy and new wells were no longer developed in 1966. Contamination continues on the reaches of Numa River, because the pumpage continues to increase. (See also W70-09733). (Knapp-USGS)
W70-09732

STUDY ON SALT WATER INTRUSION INTO GROUND WATER - PART 2. GEOCHEMICAL RESEARCH OF SALT GROUNDWATER (JAPANESE).
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02K.
W70-09733

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W70-09850

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

ESTIMATING THE TRITIUM INPUT TO GROUNDWATER FROM WINE SAMPLES: GROUNDWATER AND DIRECT RUN-OFF CONTRIBUTION TO CENTRAL EUROPEAN SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches Institut.
W. Roether.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/7, p 73-91, 1967. 19 p, 7 fig, 3 tab, 21 ref.

Descriptors: *Fallout, *Tritium, *Sampling, *Fruit crops, Groundwater, Surface waters, Rainfall, Soil water, Crops, Soil-water-plant relationships, Tracers, Tracking techniques.
Identifiers: German Federal Republic, Wines, Grapes, Vineyards.

A model is derived which allows a quantitative evaluation of wine tritium data. The tritium content of a wine sample is not determined exclusively by water taken up by the roots, but is also influenced to a large extent by direct exchange with atmospheric moisture. The soil-water fraction amounts normally to not more than 40%. Thus, wine is a sample partly of atmospheric moisture at ground level, partly of soil moisture, integrated over a period around three weeks before vintage. The tritium content of two sets of wine samples originating from two selected sites in the Federal Republic of Germany and dating back to 1949 is reported. For the period before 1955 the tritium activity of the annual groundwater recharge, including pre-thermonuclear recharge in Central Europe, is estimated from the wine data. (See also W70-09868) (Knapp-USGS)
W70-09873

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut.
K. O. Munnich, W. Roether, and L. Thilo.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/21, p 305-320, 1967. 16 p, 10 fig, 10 ref.

Descriptors: *Radioactive dating, *Groundwater, *Tritium, *Carbon radioisotopes, Fallout, Groundwater movement, Recharge, Ion exchange, Adsorption, Water chemistry, Mixing, Diffusion.
Identifiers: Germany, Rhine River.

Shallow groundwater can be dated with some accuracy on the basis of its bomb tritium content if the unsaturated soil cover and the aquifer itself are sufficiently homogeneous. A few examples from the Rhine valley are presented. The decrease in tritium level from the water table to a few meters below is nearly two orders of magnitude. Agreement between the measured or estimated variation of bomb tritium in rain during the past decade and the tritium found in shallow groundwater can be obtained if one takes into account that (a) practically no rain reaches the water table, and (b) water is mixed by diffusion. Both effects can also be observed in the soil moisture of the unsaturated soil above the water table. Carbon-14 increase in groundwater due to bombs is delayed compared to tritium, the reasons being delay in the biological system and exchange with the carbonate in the soil. A simple model is presented, which allows the evaluation of the influence of exchange on the C-14 age obtained. The deviation from the true age depends on the ratio of the carbonate content in the aquifer material to the carbonate content of the water, on the specific contact surface or the grain size, but not on the groundwater velocity. (See also W70-09868) (Knapp-USGS)
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
I. Wendt, W. Stahl, M. Geyh, and F. Fauth.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/22, p 321-337, 1967. 17 p, 11 fig, 4 tab, 6 ref.

Descriptors: *Radioactive dating, *Groundwater, *Carbon radioisotopes, Calibrations, Ion exchange, Fallout, Mixing, Water chemistry, Carbonates, Carbon dioxide, Model studies, Laboratory tests.
Identifiers: Germany, Groundwater dating.

The C-14 age of water samples is calculated by assuming that fossil carbonate is dissolved by biogenic CO2. To investigate the mechanism of the dissolution, laboratory experiments were carried out under controlled conditions. Non-radioactive CaCO3 and radioactive CO2 were used to check the validity of theoretical assumptions regarding the average C-14 activity and the C-13 value of the total carbon which is dissolved as CO2 and HCO3. Exchange between the undissolved carbon present in the CaCO3 and that present in the HCO3 was also studied. In the simple CaCO3-CO2 system the assumption of no exchange is not justified even for a constant water temperature. Correction for the initial C-14 activity by means of the C-13 value is not consistent, and the reliability of the C-14 dating method is questionable. (See also W70-09868) (Knapp-USGS)
W70-09886

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
M. A. Tamers.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/23, p 339-353, 1967. 15 p, 5 fig, 1 tab, 20 ref.

Descriptors: *Groundwater movement, *Radioactive dating, *Deserts, *Carbon radioisotopes, Carbonates, Water chemistry, Leaching, Ion exchange, Fallout, Stable isotopes, Aquifers, Limestones, Infiltration, Mixing, Evaporation.
Identifiers: Venezuela.

Radiocarbon dating of the carbonate species present in groundwater is capable of furnishing information on the recharge of underground deposits as well as directions and rates of movement. The origins of the dissolved carbonates fall under two classifications: modern carbon is provided by carbon dioxide from the atmosphere and the products of plants in the soil, and ancient carbon comes from dissolving limestone. The latter source is essentially free of radiocarbon and, therefore, causes falsely old dates for the total groundwater carbonates. An estimate of the amount of limestone dilution is the main difficulty connected with radiocarbon dating of groundwater. The methods proposed for this correction were applied to several aquifers under different conditions. Aquifers of Barquisimeto, Maracaibo, Coro, Paraguana, and Valencia in Venezuela were investigated by the method of natural radiocarbon. Ages ranging from modern to 35,000 yr were obtained. In general, the older dates correlate well with arid climatic conditions. However, deep wells providing modern water have been observed in virtual deserts, but these are explained by the recharge of irrigation water previously extracted from the ground. (See also W70-09868) (Knapp-USGS)
W70-09887

2G. Water in Soils

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09518

ADSORPTION OF VIRUSES ON MINERAL SURFACES,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 05B.
W70-09520

PERSISTENCE OF PESTICIDE RESIDUES IN SOILS,
Agricultural Research Service, Beltsville, Md. Crops Research Div.
For primary bibliographic entry see Field 05B.
W70-09562

EFFECT OF MEMBRANE PORE SIZE ON THE MEASUREMENT OF WATER TENSION IN BENTONITE SUSPENSIONS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
Amos Banin, Brian G. Davey, and Philip F. Low.
Soil Science of America Proceedings, Vol 32, No 2, p 306-309, May-June 1968. 4 p, 5 fig, 9 ref.

Descriptors: *Membrane processes, *Porosity, *Clay minerals, *Moisture tension, *Osmosis, Osmotic pressure, Turbidity, Colloids, Tensiometers.
Identifiers: Clay-water systems.

A pressure-transducer tensiometer and a dynamic osmometer were used to measure water tensions and osmotic pressures in clay-water systems. The two methods of measurement produced the same results. Different membranes, having pore sizes ranging from 0.004 to 0.8 microns were used with the tensiometer. Measured water tension of a given system depended on the pore size of the membrane; as the pore size increased, the tension decreased. However, little or no turbidity appears in a solution when it is separated from a clay suspension by a membrane having pores this small; therefore, the relationship between pore size and tension was not due to differences in membrane permeability to the clay particles. Nor was it due to differences in membrane permeability to dissolved solutes. No lasting tension developed when a NaCl solution or an extract of the clay were utilized in place of the clay suspensions. Two possible explanations were proposed: (1) entrance of particles into the pores was all that was required to lower the reflection coefficient, and (2) the gelation of the clay suspensions within the pores produced gels having particle densities and arrangements and, hence, permeabilities to dissolved solutes, that were dependent on the dimensions of these pores. (Knapp-USGS)
W70-09567

ENERGY RELATIONS IN WATER TRANSPORT AND SUPPLY OF WATER BY CAPILLARY RISE,
Agrophysical Inst., Leningrad (USSR).
N. Bondarenko, and S. Nerpin.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 527-535, 1968. 9 p, 6 fig, 10 ref.

Descriptors: *Soil water movement, *Water properties, *Viscosity, *Plasticity, *Yield strength, Rheology, Flow, Porous media, Unsaturated flow, Darcys law, Hydrogen bonding, Laboratory tests, Hydraulic gradient, Hydraulic conductivity.
Identifiers: Bingham bodies, Visco-plastic properties.

It is shown that water, including pure water, is not an exact Newtonian liquid and should be characterized as a Bingham body by two coefficients: plastic viscosity, and yield stress of order 0.01 dyne/sq cm. The yield stress of pure water may be caused by the formation of quasi-crystalline molecular frames due to hydrogen bonds. Taking into account the full rheological characteristics of water, it is possible to explain the deviation of water flow in porous media from Darcy's law (in the case of full saturation) and from the analogous relation for unsaturated soils. The influence of visco-plastic properties of water on equilibrium and transfer of water in unsaturated zone is shown. The data obtained give a rigorous physical base to predict and control soil moisture content. (See also W70-09569) (Knapp-USGS)
W70-09568

DEVELOPMENT OF EQUATIONS DESCRIBING TRANSPORT OF MASS, MOMENTUM AND ENERGY IN SOILS,
Agricultural Research Service, Madison, Wis.; and Illinois Univ., Urbana.
P. A. C. Raats, and A. Klute.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 535-546, 1968. 12 p, 23 ref.

Descriptors: *Soil water movement, *Mass transfer, *Energy transfer, *Momentum transfer, Soils, Thermodynamics, Flow, Porous media, Entropy, Physicochemical properties, Energy budget, Heat balance, Continuity equation.
Identifiers: Soil transport equations, Multiphase flow, Mixtures, Continuum theory.

A theory of mixtures is used as a basis for the construction of a macroscopic, comprehensive theory for transport of mass, momentum, and energy in soils. An unsaturated soil is regarded as a mixture of a solid phase, an aqueous phase, and a gaseous phase. Balances of mass, momentum, and energy are written for the phases. The necessary and sufficient assumptions for the force balance of the aqueous phase to reduce to Darcy's law are stated. From the balance of energy and the Gibb's equation, a balance of entropy is derived. It is pointed out that there are indications that the foundations of thermodynamics of irreversible processes are not as evident and as clear as one is often led to believe. (See also W70-09570) (Knapp-USGS)
W70-09569

EFFECT OF COMPACTNESS AND INITIAL MOISTURE CONTENT OF THE SOIL ON THE PROCESS OF CAPILLARY RISE,
Technical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water Resources Development.
I. Ijjas.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 547-559, 1968. 13 p, 9 fig.

Descriptors: *Capillary action, *Soil water movement, *Soil structure, Moisture content, Capillary conductivity, Mathematical studies, Soil compaction, Soil density, Soil horizons, Soil moisture, Soil moisture meters, Tracers.
Identifiers: Initial moisture content.

The effect of compactness and initial (natural) moisture content of the soil on the process of capillary rise and on capillary transmissivity is discussed. The analog between deviations of capillary characteristics in soils of identical grain size distribution, but with different compactness and initial moisture

content, and those in soils of different grading is examined. A comparison is made between capillary processes taking place in soils composed of two layers. Characteristics of capillary flow directed upwards and enclosing an angle between 0 and 90 deg with the horizontal are also studied. (See also W70-09571) (Knapp-USGS)
W70-09570

THE DYNAMICS OF CAPILLARY RISE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. R. Philip.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 559-564, 1968. 6 p, 3 fig, 5 ref.

Descriptors: *Capillary action, *Soil water movement, *Mathematical studies, Capillary conductivity, Unsaturated flow, Soil moisture, Equations.
Identifiers: Linearization, Similarity method.

The problem of the dynamics of capillary rise associated with the sudden immersion of the bottom of a soil column in free water (and of the corresponding sub-irrigation problem) is examined. An 'exact' method developed for analyzing the dynamics of one-dimensional infiltration is appropriate at small times, but problems of convergence set limits to its applicability. The equilibrium situation approached at large times is, of course, readily found; but the 'exact' bridging of the gap between the 'small-time' solution and the final equilibrium appears to require the use of high-speed computers. (See also W70-09572) (Knapp-USGS)
W70-09571

STEADY FLOW IN THE ZONE OF AERATION,
Geological Survey, Denver, Colo.; and Geological Survey, Little Rock, Ark.
R. W. Stallman, and J. E. Reed.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 565-578, 1968. 14 p, 4 fig, 2 tab, 13 ref.

Descriptors: *Hydraulic conductivity, *Capillary conductivity, *Soil water movement, *Zone of Aeration, Darcys law, Hydraulic gradient, Porosity, Unsaturated flow, Groundwater movement, Steady flow, Recharge, Infilitration.
Identifiers: Soil water discharge.

Hydraulic conductivity in the steady upward flow in the zone of aeration can be estimated using data on the porosity and the thickness of the hydraulically conductive zone above the water table. For downward flow hydraulic conductivity is estimated using the liquid pressure-head measured far above the water table. It seems unlikely that vertical velocity in the zone of aeration can be estimated within two orders of magnitude by use of Darcy's law with field observations of the head distribution and laboratory measurement of conductivity. Emphasis in research is needed on the following: (1) Field applications of theories of multifluid flow; (2) Field measurement of velocity in the zone of aeration; (3) Listing in reports of laboratory experiments all pertinent data on porous media and liquids used; (4) The relation between plant growth factors and depth to the water table. (See also W70-09573) (Knapp-USGS)
W70-09572

WATER TRANSMISSION BY EVAPORATION AND FROST ACTION AT DIFFERENT SOIL CONDITIONS IN SUCTION LYSIMETERS,
W. Czeratzki.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 579-591, 1968. 13 p, 11 fig, 3 tab, 15 ref.

Descriptors: *Soil water movement, *Lysimeters, *Instrumentation, Evapotranspiration, Evaporation, Moisture tension, Moisture content, Pore pressure, Water balance, Hydrologic budget.
Identifiers: *Deep lysimeters.

Various methods used for investigating water transmission in soils in connection with problems of water recharge, evaporation and evapotranspiration are reviewed. The construction of lysimeters must be such that their water transmitting properties are similar to those occurring under natural conditions. One of the greatest difficulties in lysimeters with no water table is the establishment of water outflow under suction conditions as in a continuous soil profile. With a percolation funnel the capillary system ends at the bottom of the soil monolith so that the outflow of the percolation water takes place with zero suction. Establishment of suction conditions at least in the upper part of the root zone is possible with deep lysimeters. In shallow lysimeters the impeded water outflow leads to overmoistening of the soil monolith and consequently to unnatural conditions of water transfer. This difficulty can be eliminated by using suction lysimeters with bottoms consisting of a suction device for maintaining variable water suction. The results of tests of suction lysimeters are compared with the work of other authors and the possibilities created by this type of lysimeter for the investigation of soil-water-plant-relations are described. (See also W70-09574) (Knapp-USGS)
W70-09573

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
V. Puustjarvi.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 591-595, 1968. 5 p, 3 tab.

Descriptors: *Evaporation control, *Peat, Marshes, Mulching, Groundwater movement, Soil water movement, Evaporation, Water utilization, Soil management, Water conservation.
Identifiers: *Peat culture, Finland.

In recent years the Agricultural Chemistry Institute of Helsinki University has been attempting to develop a water saving peat culture method. The method is called peat basin culture. The surface of the soil is covered by a polyethylene film and the edges of the film are turned up to a height of 3-5 cm. Fertilized peat is placed in the basin so formed and is then soaked thoroughly with water. A water layer of 3-5 can remain at the bottom of the basin to assure an even supply of moisture to the plants. Groundwater is not necessary and it is not used when the peat layer is thin. The evaporation can be decreased further by covering the peat layer with a polyethylene film or by using plastic greenhouses. The quality of the peat used in basin culture must be suitable for this purpose. To remain in equilibrium with the groundwater the air volume of the peat must be at least 20%. The capillary rise of the water from the groundwater to the surface of the peat layer must be rapid and even. The advantages of the method: (1) There is no unnecessary loss of water or there is no leaching; (2) Pathogens cannot spread from the soil to the culture medium; (3) Growth is rapid and even; (4) It is a simple and easy method to master. (See also W70-09575) (Knapp-USGS)
W70-09574

EVAPORATION FROM BARE SOIL AND THE WAYS OF REDUCING IT,
Agrophysical Inst., Leningrad (USSR).
S. Nerpin, S. Pakshina, and N. Bondarenko.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 595-602, 1968. 8 p, 7 fig, 16 ref.

Descriptors: *Evaporation, *Soil water movement, *Evaporation control, *Mulching, Capillary action, Capillary conductivity, Diffusion, Soil conservation, Water conservation, Soil management, Hydrogen bonding, Water utilization.
Identifiers: *Capillary conductivity reduction.

Evaporation from bare soil is an unproductive process in arid and semiarid regions. It not only reduces the soil moisture content, but also results in salt accumulation in the root zone. A liquid evaporation mechanism is proposed to take into account both diffusive and film water flow, and explains the apparent deviation from Thompson's law and controlling evaporation intensity as well. Some surface active substances when applied to the surface soil layer bring about a reduction in evaporation intensity not only because they interrupt the film flow on the capillary surface, but also because they reduce the diffusive and thermo-capillary flow. The effect of non-ionic surfactants which strongly protect the soil surface from evaporation depends on the intensity of the bonds between surfactants and the soil particles. A temperature increase results in progressive transfer of surfactant molecules from the surface of the particles to bulk. In such a case protection is decreased, and at a critical of temperature, hydrogen bonds are broken and all protection is lost. The laboratory data presented confirm this conception. The critical temperature for investigated surfactants is about 60 deg C. (See also W70-09576) (Knapp-USGS)
W70-09575

RELATION BETWEEN EVAPORATION AND SOIL HYDROCONSTANTS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. of Hydrology and Hydraulics.
Jan Benetin, and Julia Cervenkova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 602-610, 1968. 9 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Evaporation, *Soil water movement, *Soil physical properties, Capillary action, Saline soils, Saline water systems, Saline water, Salts, Moisture content, Diffusion, Drying.
Identifiers: Soil salinization.

Evaporation as a cause of the soil salinization process is proportional to the difference between the vapor tension of the soil air and that of the surrounding atmospheric air. As the soil vapor tension is dependent upon the soil moisture content, the affinity to liquid water to the solid soil phase affects the course of soil water evaporation. A method is given for estimating the soil water limits from the recorded course of soil sample drying. Results from experiments carried out with various soils show that the intensity of evaporation is still considerable at the low soil moisture contents and it depends remarkably upon the chemical composition of the soil. Soils saturated with K- and Na-ions evaporate more rapidly at low water contents than soils saturated with Ca-ions. The differences in evaporation decrease with increase in soil water content. Slow drying of saline soils is not due to the chemical composition of the soils, but to the small water flow moving into the surface layer. (See also W70-09577) (Knapp-USGS)
W70-09576

THE MOVEMENTS OF DIFFERENT SALT SOLUTIONS IN SOIL PROFILES,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Jutato Intezete, Budapest.
I. Szabolcs, and J. Lesztak.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium,

The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 611-621, 1968. 11 p, 6 fig, 2 tab, 11 ref.

Descriptors: *Soil water movement, *Saline water systems, *Soil structure, *Permeability, Evaporation, Soil physical properties, Soil chemical properties, Soil chemistry, Water chemistry.
Identifiers: Soil salinity-permeability relations.

Experiments were made to study the laws of capillary movement of salt solutions of different composition in soil profiles. Fore the experimental purposes 1 meter high plastic tubes, 12 cm in diameter, were filled with a chernozem soil. Using capillary wetting from the bottom, the soils were treated with 0.1 N solutions of Na, Na2 and Mg sulfate, chloride, and carbonate. In the case of capillary wetting from the bottom, the solutions' movement was significant only if free evaporation was assured. In the absence of evaporation only the lowest, about 15 cm thick soil layer came into contact with the salt solutions. No significant differences could be observed between the effects of the various salts. When the capillary movement was aided by evaporation, the movements of the various salt solutions within the soil column differed to a great extent from each other. While the solutions of Mg chloride and neutral sodium salts reached the surface of the 1 meter high soil column, the soda solution penetrated only the lowest, 15 cm thick layer. The influence of the soda solution intensely manifested itself by significantly changing the physical properites of this layer. As a result treating the soils with soda solution, the microaggregate compositon of the soil layer involved changed, the water permeability of that soil layer was practically reduced to zero, the structure factor decreased, while the dispersity increased and, as compared to the soils treated only with the solutions of neutral sodium salts, the plasticity also increased. If sodium salts capable of alkaline hydrolysis, especially soda, can be found in the soil, they exert a significant and detrimental influence on the water and salt movement which take place in the soil and on the soil's physical and water regime properties. (See also W70-09578) (Knapp-USGS)
W70-09577

ON THE PROBLEM OF SALT DIFFUSION IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. A. Ogilvy.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 622-628, 1968. 7 p, 8 ref.

Descriptors: *Saline water systems, *Soil water movement, *Diffusion, Mathematical studies, Equations, Diffusivity, Capillary action, Infiltration, Arid lands, Discharge (Water), Permeability, Soil properties, Convection.
Identifiers: Soil salt movement.

With small amounts of infiltration which are generally observed in arid regions in the zone of aeration an ascending salt flow counteracts a descending convection salt transfer by infiltrating water. At distance from the solid walls of the rock skeleton exceeding the mean free path of translation of particles, diffusion in free interstitial water is similar to that in large solution volumes. In bound water, translation jumps of the particles occur with different frequency. Therefore, the diffusion coefficient in bound water may greatly differ from the corresponding free water coefficient. In rocks, the solute transfer in bound water is proportional to the rock's specific surface and the thickness of the bound water film. In sands, the solutes are mainly transferred in free water, while in clays they move primarily within the bound water. The diffusion phenomena in the zone of aeration of arid regions account for the processes of carbonate cementation of this zone, for the appearance of gypsum crusts in it and also for the observed relations between occurrence of ombrophytes and the groundwater salinity. (See also W70-09579) (Knapp-USGS)
W70-09578

EFFECT OF SOIL SALINITY ON THE LOSS OF WATER FROM VEGETATED AND FALLOW SOIL,
Geological Survey, Phoenix, Ariz.
T. E. A. van Hylckama.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 635-644, 1968. 10 p, 4 fig, 4 tab, 18 ref.

Descriptors: *Evapotranspiration, *Saline water, *Phreatophytes, *Tamarisk, *Arizona, Lysimeters, Consumptive use, On-site tests, Arid lands, Water levels, Water management (Applied), Water conservation.
Identifiers: Evapotranspirimeters.

In the semiarid zone of the southwestern United States some six million hectares near washes and along rivers are covered by a dense growth of riparian or phreatophytic vegetation, consisting very often of pure stands of saltcedar (Tamarix pentandra). This vegetation, having a nearly unlimited access to water, transpires large quantities, estimated to total over 29,000 million cu km per year. In order to measure the actual rate of evapotranspiration 6 large evapotranspirometers (surface area about 80 sq m) were installed near Buckeye, Arizona in 1959 and another 5 in 1962. In 1963 the salinity of the groundwater in the older tanks had risen from an original 4 to over 200 parts per thousand. Although saltcedar is reported to tolerate and thrive on soil moisture of high salinity, the tanks were flushed out until the salinity of the effluent was back to the original. Whereas in 1963 the water use varied between 80 and 200 cu m per tank per year (depending on depth to water in the tanks), after flushing, the use increased by more than 50%. It is frequently assumed, when water use by phreatophytes is estimated, that the plants have access to water of low salinity. The data presented show that this assumption may not always be right and that the actual water losses may be less than estimated by as much as 40%. (See also W70-09580) (Knapp-USGS)
W70-09579

METHODS AND FORMULAS FOR THE DETERMINATION OF SOIL EVAPORATION AND SOIL MOISTURE CONTENT FROM HYDROMETEOROLGICAL DATA,
Hydraulic Research Inst., Bratislava (Czechoslovakia).O
Artur Sermer.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 644-650, 1968. 7 p, 7 fig.

Descriptors: *Soil water movement, *Evapotranspiration, Lysimeters, Hydrology, Soil moisture, Water balance, Infilitration, Laboratory tests.
Identifiers: Czechoslovakia.

Soil water movement and evapotranspiration are studied at Ziharec, Czechoslovakia by using lysimeters, evaporimeters, and moisture balance studies. Results of recent studies are presented in the forms of equations and graphs, and methods of conserving water are discussed. (See also W70-09581) (Knapp-USGS)
W70-09580

VERTICAL DISTRIBUTION OF EXCHANGEABLE CATIONS IN SOILS OF ARID ZONES AS AN INDICATION TO THE DEPTH OF WATER INFILTRATION,
Egyptian Desert Inst., Cairo.
Ahmad Amin Hassan.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 650-658. 9 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Soil water movement, *Leaching, *Cation exchange, *Soil chemistry, *New Mexico, Water chemistry, Solutes, Aqueous solutions, Ion exchange, Infiltration, Arid lands, Evaporation, Chemical precipitation, Saline soils.
Identifiers: Socorro (N M).

The climate, physiography, geology, and soils of the Socorro area, New Mexico are described, and the distribution of exchangeable cations in the soils is discussed. Soil samples were collected from 79 profiles and ammonium acetate was used to extract exchangeable cations. The amount of exchangeable calcium and magnesium ions tends generally to decrease until the lower B or C horizons are reached; then there is usually an increase in the amount of these ions. The amount of exchangeable sodium ion generally increases with depth until the lower B or C horizons, then it decreases. Potassium showed a random distribution in most of the soils. The abrupt change in distribution of these exchangeable cations coincides with the lime accumulation zone of the soil. Exchange distribution indices for soils show that much of the exchangeable Ca, Mg, and Na moving downward through the soil, were retained by the B and the C horizon. It was assumed that the soil profile has been developed from a relatively uniform material. From the exchange distribution indices, it may be justified to conclude that little infiltration of water or none in the lower layers of these soils take place. A negligible penetration of water into the soil, followed by evaporation of the moisture back into the atmosphere, prevents the possibility of through leaching of the surface soil. (See also W70-09582) (Knapp-USGS)
W70-09581

METHODS AND DEVICES FOR MEASURING MOISTURE, EVAPORATION AND AVAILABLE WET RATIO OF SOIL BASED ON THE ANALYSIS OF ITS HEAT REGIME,
Committee for the I.H.D., Moscow (USSR).
A. F. Chudnovsky.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 658-669, 1968. 12 p, 3 fig.

Descriptors: *Soil moisture, *Evaporation, *Moisture content, *Instrumentation, *Heat budget, Soil water movement, Soil physical properties, Soil temperature, Computers, Equations.
Identifiers: *Soil heat regime.

A discussion is given of the theoretical aspects of the determination of soil-moisture content from the thermal properties of the medium. The possibilities of application are reviewed. An evaluation is made of the use of the energy balance approach for determining evaporation from bare soils. A plan is given for automatic equipment connected to a computer. (See also W70-09583) (Knapp-USGS)
W70-09582

WATER MOVEMENT AND USE OF PEAT SOILS IN LOWLAND SWAMPS OF THE U.S.S.R.,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
K. Shishkov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 682-687, 1968. 6 p, 1 fig, 5 tab.

Descriptors: *Soil water movement, *Peat, *Swamps, Infiltration, Tensiometers, Soil management, Water conservation, Water yield, Diffusion, Water storage.

Identifiers: *USSR.

Water penetration rates in the peat soils fluctuate from 0.05 m/hr. to 0.15 m/hr. The water penetration rate during the first hour ranges from 0.007 m/hr to 0.49 m/hr. Steady water flow penetration rate is established as 0.02 to 14.4 m/hr. The minimum height of capillary rise in peat soils is 47 to 55 cm and the maximum rise is from 63 to 78 cm. Tensiometers with air vacuummeter were used for water vapor condensation study in peat soils. Total vapor condensation at 20 cm during 56 days was 8.7 mm/sq cm and at 30 cm 10.9 mm/sq cm. Depth of root expansion depends on plant species and drainage norms. The roots of cabbage plants penetrate 100 cm into the soil and alfalfa roots 104 cm with fluctuations of water table from 50 cm to 134 cm. Most of the cabbage plants roots are found in the layer 0 to 20 cm (73%). Moisture depression affecting plant growth depends on soil properties, plant species and weather during vegetative periods. On river silt loam peat the depression for fodder beet, sugar beet, and maize begins at a water storage level about 23 to 29%: for carrot, red-beet, cabbage, and perennial grass on peat moors, it begins at a water storage level about 17 to 29%. (See also W70-09584) (Knapp-USGS)
W70-09583

USE OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS UNDER SPRINKLING IRRIGATION IN ARID ZONES,
All-Union Scientific Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
M. V. Preobrazhenskaya.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 688-693, 1968. 6 p, 3 fig, 4 tab, 5 ref.

Descriptors: *Consumptive use, *Irrigation water, *Cotton, Arid lands, Lysimeters, Evapotranspiration, Leaching, Sprinkler irrigation, Irrigation practices, Water conservation, Water management (Applied).
Identifiers: Cotton irrigation.

Sprinkling irrigation of cotton is useful in arid zones. It is most efficient when there is a shllow groundwater table--of fresh or only slightly mineralized water--at the beginning of the vegetation period. This condition can be produced by autumn-winter waterings, designed to produce such storage and also to flush saline patches of the soil. Field tests, using lysimeters 4 m deep showed that after 3000 or 3500 cu m/ha of winter irrigation for recharge and flushing, the water table came up to about 1.3 or 1.5 m: sprinkling irrigation in the summer, using 1500 to 2000 cu m/ha in 3 or 4 waterings then produced high cotton yields (30 to 40 centners per ha), and the water table sank to 3.5 or 4.0 m. The total water consumption with this technique was 6500 to 7500 cu m/ha, somewhat smaller than when the cotton was irrigated only in the growing season by furrow irrigation, but the satisfaction of part of the water need by autumn or winter application releases considerable resources of water for irrigation of additional areas in summer time. (See also W70-09585) (Knapp-USGS)
W70-09584

WATER MOVEMENT AND ITS UTILIZATION BY PLANTS UNDER THE DEEP WATER STORAGE IN SOIL BY USING OFF-SEASON IRRIGATION,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
O. G. Grammaticati.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 694-704, 1968. 11 p, 4 fig, 7 tab, 4 ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Soil water movement, *Evapotranspiration, Drying, Evaporation, Consumptive use, Irrigation water, Water conservation, Irrigation practices.
Identifiers: Deep soil water storage.

To determine the water uptake by roots from the deep soil layers, the root penetration and soil moisture movement within and beyond the root zone and on the plots without plants were studied. The depth of root penetration of most field crops was more than 1 metre, and that of sunflower and winter wheat reached 270-300 cm when the soil was deeply irrigated. A few plant roots penetrate into the deep soil layers. However, intense growth and high physiological activity of the roots make it possible for the plants to utilize a great amount of moisture from the deep soil layers. Physiological activity of the root system in the deep soil layers consists not only of moisture uptake from the soil, but also of water transfer to the upper tier which is located in dry soils. Evaporation from bare soil is intense in the upper soil layers, gradually decreases with depth, and finally dies away at a depth of 70 to 80 cm. Therefore, in deeper soil layers the process of biological desiccation takes place if the roots penetrate into these layers. The zone of 'the principal biological desiccation' lies deeper, and its depth depends on the root penetration and may reach to 280 or 300 cm. The uptake from the zone of the principal biological desiccation reaches 1600 cubic metre per ha, equal to 45% of consumptive use during the whole vegetative season. The stable harvest obtained by using deep off-season irrigation may be explained by the presence of water in the principal biological zone where there is no loss of water by evaporation, but where stored water serves as a reserve to protect the plants from drought. (See also W70-09586) (Knapp-USGS)
W70-09585

WATER REGIME OF THE SOIL AS AFFECTED BY VEGETATION,
Research Inst. of Agricultural Economics, Budapest (Hungary).
K. Kallay.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 704-711, 1968. 8 p, 4 tab, 10 ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Evaporation, *Evapotranspiration, Water storage, Soil water movement, Consumptive use, Seepage, Heat budget, Water balance.
Identifiers: Hungary, Soil water-groundwater relationships.

The effect of winter wheat, maize and lucerne on the water regime of the soil in the semiarid climate of central and eastern Hungary, on deep soil with groundwater level below 300 cm was studied. During three winters, on average, 72% of the precipitation was stored in deeply loosened, uncropped soil, 66% under winter wheat, 55% under lucerne, and 26% under natural grassland. During the vegetation period, foliage retains part of the precipitation, lucerne retained 2-4 mm precipitation, but immediately after the harvest of hay only 1 mm was retained. In August 1938, 220 mm of precipitation wetted well cultivated wheat stubble to a depth of 60-70 cm, while under both maize and sugar beet the depth was 30 cm, and under lucerne, only 20 cm. Transpiration during the phase of rapid development of thirty to forty days, represents 70-85% of the annual absolute water consumption. In this critical period the moisture reserve previously stored by the soil may be exhausted, and damage by drought may occur. The losses from the water reserve are increased by evaporation from the soil. Measurements of the absolute water consumption of several wheat varieties, and of lucerne, were made. The absolute quantity of water transpired on soils of good and poor nutritional status, with great differences in crop yields, was the same. On the basis of these investigations conducted in Hungary some measure to be taken in this field to obtain higher crop yields are suggested. (See also W70-09587) (Knapp-USGS)
W70-09586

POTENTIAL EVAPOTRANSPIRATION OF MAIZE (FRENCH),
Institute of Irrigation Research, Prague (Czechoslovakia).
Miloslav Pycha.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 711-723, 1968. 13 p, 2 fig, 9 tab, 9 ref.

Descriptors: *Soil-water-plant relationships, *Supplemental irrigation, *Corn (Field), Water balance, Evapotranspiration, Humidity, Consumptive use, Frequency analysis, Demonstration watershed, Experimental farms.
Identifiers: Czechoslovakia, Corn irrigation.

With accurate data more economical supplemental irrigation systems can be designed. One of the required data is the water consumption of various crops. Investigations concerning the consumption of maize started in Czechoslovakia in 1955. Consumption was determined under natural conditions from water balance studies. Optimum conditions of water supply were obtained by irrigation. Consumption was calculated weekly, using soil moisture determinations at a depth of 100 cm. A correlation between the yearly consumption and the saturation deficit of the air was determined. The course of consumption during growth was characterized by a biological curve for different stages of growth. The coefficients of this curve were determined from the weekly data obtained with the water balance and the sum of daily values of the saturation deficit during the period under consideration. These data were used to calculate the water consumption of maize during the period from 1932-1962. The results were used in a frequency analysis for the determination of water consumption of maize. (See also W70-09588) (Knapp-USGS)
W70-09587

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
O. Klausing.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 724-729, 1968. 6 p, 1 tab, 10 ref.

Descriptors: *Soil-water-plant relationships, *Drought resistance, Crop response, Potatoes, Moisture stress, Moisture content, Evapotranspiration, Physiological ecology, Plant physiology, Drought tolerance, Moisture deficit, Water shortage, Capillary water.
Identifiers: Germany.

During a dry summer period in Germany, potato plants extracted water from soil beyond 15 atm. suction. These measurements were followed by laboratory studies on soil moisture and plant growth under limiting conditions of incipient drying and permanent wilting. The result is a new thermodynamic treatment of soil moisture in respect of capillary water and film water, and their importance for specifying availability. The term 'available water' has to be defined with the same thermodynamic differentiation on the basis of plant water relations studies in laboratory and in the field. These ecophysiological investigations suggest that the constitutional drought resistance of the higher plants is conditioned by relative independence of capillary forces and osmotic forces in the cellular plant tissue and in the whole plant body. Therefore the plant constitution (especially its drought resistance) has to be considered in all questions about the extraction of soil moisture by plants under dry limit conditions. (See also W70-09589) (Knapp-USGS)
W70-09588

EVAPOTRANSPIRATION OF PLANTS AND FLUCTUATION OF THE GROUNDWATER TABLE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland). Water Physics Div.
Jerzy Jaworski.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 730-739, 1968. 10 p, 10 fig, 1 tab, 17 ref.

Descriptors: *Soil-water-plant relationships, *Drought resistance, *Capillary water, Moisture tension, Phreatophytes, Crop response, Moisture content, Evapotranspiration, Plant physiology, Physiological ecology, Drought tolerance, Water shortage, Consumptive use, Water level fluctuations.
Identifiers: *Soil water-groundwater relationships, Poland.

Evapotranspiration by plants--in particular by woody plants--is quite intense in the growing period (725 mm). With a considerable precipitation deficit, the water must come from the zone of the capillary rise of soil moisture. The moisture uptake from this zone during the evapotranspiration process is reflected in short-term daily fluctuations of the groundwater level. The fluctuation range depends on the kind of vegetation, the intensity of transpiration, and whether roots are deep or shallow. The groundwater fluctuations influence the side inflow of groundwater from adjacent areas with less intense transpiration. Considerable daily losses of soil moisture by evapotranspiration in a rainless period cause a continuous decline of the average groundwater level. For each 1 mm of daily evapotranspiration from poplars there was a daytime fall of the groundwater level of about 2 cm. This daily fluctuation sometimes reached 17 cm, but under a meadow or potatoes the fluctuations were very slight, or they did not occur at all. The daily fluctuation is less intense on a cloudy day, probably because of smaller evapotranspiration intensity. Studies of the source of water for plants--in particular, for deeply rooted plants--must not be restricted to the unsaturated zone only. They may draw on groundwater. (See also W70-09590) (Knapp-USGS)
W70-09589

THE INFLUENCE OF VARIOUS AGRICULTURAL PRACTICES ON SOIL WATER AND IN THE ZONE OF AERATION OF CHERNOZEMS (FRENCH),
Dilko Dilkov.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 739-742, 1968. 4 p, 2 tab.

Descriptors: *Soil-water-plant relationships, *Chernozems, Soil water movement, Moisture content, Field capacity, Hydraulic conductivity, Consumptive use, Clays, Loess, Zone of aeration, Corn (Field), Alfalfa.
Identifiers: Bulgaria.

Investigations on soil moisture in the unsaturated zone of chernozems in the Northern part of Bulgaria showed interesting regularities due to the influence of various crops and the hydraulic conductivity of the subsoil. The depth to which the soil moisture is affected depends on the granular composition of the soil. In typical loess soils the size fraction from 0.05-0.01 mm predominated. An abrupt change in soil water movement was observed when the soil moisture content was at 65-70% of field capacity. In this region the crop also affected the hydrological situation in the unsaturated zone, with a rooting depth from 0.5 to 2.0 m to a layer in which more clayey material was present. In this layer the moisture content was about 85-90% of field capacity. Large differences in the soil moisture in the unsaturated zone were observed with the various crops. Alfalfa, grown during 5-6 years on the same spot, showed the largest effect on the recharge of the subsoil. This crop used all the water which could be taken up by the roots to a depth of 608 m. A similar result was obtained with maize, and to a much shallower depth with other crops. The various crops affected the soil moisture in the unsaturated zone and also the vertical movements. (See also W70-09591) (Knapp-USGS)
W70-09590

FIRST MEASUREMENTS OF SOIL WATER EVAPORATION WITH THE AID OF LYSIMETERS IN CZECHOSLOVAKIA (FRENCH),
Institute for Protection of Monuments and Nature, Bratislava (Czechoslovakia).
Stefan Fekete.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 742-748, 1968. 7 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Evaporation, *Evapotranspiration, Water balance, Lysimeters, Surveys, Instrumentation, Mapping, On-site tests.
Identifiers: *Czechoslovakia.

Research on soil evaporation in Czechoslovakia is described and the first map of soil evaporation distribution in the eastern part of the Czechoslovak Socialist Republic (Slovakia) is presented. A summary of methods for establishing soil evaporation used in Czechoslovakia is given and original Czechoslovak literature dealing with this problem is listed. (See also W70-09568) (Knapp-USGS)
W70-09592

DETERMINATION OF STORAGE COEFFICIENTS FROM OBSERVATION OF GROUNDWATER LEVELS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 966-990, 1968. 25 p, 15 fig, 1 tab, 13 ref, append.

Descriptors: *Storage coefficient, *Groundwater movement, *Water level fluctuations, *Soil water movement, *Saturated flow, Storage capacity, Analytical techniques, Hydrogeology, Water balance, Hydrologic budget.
Identifiers: Groundwater level fluctuations.

Particular solutions of the basic differential equation for non-steady groundwater flow between parallel drainage channels show to what degree the fluctuations of the groundwater table depend on the storage coefficient. In areas with not too small spacings of the drainage channels, the fluctuations of the groundwater table can be considered with a good approximation as being directly proportional to the inflow (excess precipitation or capillary rise) through the upper boundary of the considered area and as inversely proportional to the storage coefficient. In such areas the knowledge of maximum and minimum groundwater levels (winter and summer) and of the corresponding values of excess precipitation and capillary rise is sufficient for a determination of the storage coefficient. From measurements of the relation between moisture suction and moisture content in sandy soils it is known that at the same moisture suction a smaller grain size involves a smaller air content and therefore also a smaller storage coefficient. This agrees with the variations in the groundwater level fluctuation as shown in some maps: small fluctuations in areas with coarse sandy soils, large fluctuations in areas with fine sandy soils. (See also W70-09709 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09708

UNSATURATED SOIL MOISTURE CONDITIONS STUDIED FROM FIELD OBSERVATIONS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 952-966, 1968. 15 p, 16 fig, 1 tab, 3 ref.

Descriptors: *Unsaturated flow, *Soil water movement, *Mathematical studies, *Analytical techniques, Hydrogeology, Water balance, Hydrologic budget, Runoff, Infiltration, Evapotranspiration, Storage capacity, Soil moisture.
Identifiers: Groundwater movement calculation, Soil water movement calculation, Graphical methods.

The changes in the depth of the groundwater table are the result of the integrated effects of rain, discharge, evaporation and storage. It is possible to reconstruct the values for the quantity of discharge, real evaporation and storage if rainfall and groundwater depth are given. This can be carried out along lines of fitting the data to physical formulae or along lines of graphical analyses. The graphical method is accessible to anyone without need of complicated mathematical or laboratory equipment. Methods for its use are given and discussed. (See also W70-09710 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09709

TOP WATER AND INTERSOIL RUNOFF OF SNOWMELT AND RAINFALL WATER,
Hydrometeorological Research Center, Moscow (USSR).
A. I. Subbotin.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 946-951, 1968. 6 p, 1 fig, 9 ref.

Descriptors: *Soil water movement, *Saturated flow, *Subsurface runoff, Snowmelt, Rainfall, Rainfall intensity, Percolating water, Infiltration, Recharge.
Identifiers: *Top water (Saturated soil water movement).

Top water, a temporary saturated soil water zone, and intersoil runoff appear as an effect of heavy rainfall and snowmelt. Top waters usually arise in a podzol soil; however, in spring they can arise also in homogeneous soil (chernoziom, loess), since at this time an impermeable stratum of still frozen soil may occur under the thawed-out layer. Field and laboratory research showed the important role of top water and intersoil runoff in the aeration zone and in the runoff originating from rainfall and snowmelt. (See also W70-09711 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09710

VARIATIONS IN SOIL MOISTURE STORAGE DURING THE WINTER HALF YEAR,
Technical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water Resources Development.
L. Szabo.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 936-946, 1968. 11 p, 4 fig, 8 ref.

Descriptors: *Soil moisture, *Storage capacity, *Winter, *Soil physical properties, *Frozen soils, Freezing, Wetting, Drying, Mathematical studies, Infiltration, Percolation, Water storage, Frost.
Identifiers: Soil moisture storage (Seasonal).

moisture regime of the top soil is decisively in-
nced by weather in addition to physical and
ctural properties of the soil, nature of vegeta-
cover, and the depth of the groundwater table.
change in the moisture content of the top soil
ıe winter half-year were related to some charac-
stic soil types. The instantaneous moisture con-
of the top soil subjected to water-content
nges (soaking, drying, freezing) can be deter-
ed for a given point of time in an indirect way
ısing formulae based on precipitation conditons
ter loading) prevailing in the preceding period.
e also W70-09712 and W70-09568 thru W70-
92) (Knapp-USGS)
0-09711

**ALUATION OF POROSITY OF DRAINING
IL USING DISCHARGE HYDROGRAPHS
RENCH),**
te Coll. of Agronomical Science, Gembloux
elgium).
Sine, and S. Gaspar.
Water in the Unsaturated Zone, Vol II,
oceedings of the Wageningen Symposium, The
therlands, June 19-25, 1966, International As-
iation of Scientific Hydrology, Publication No
p 923-936, 1968. 14 p, 8 fig, 6 tab, 11 ref.

scriptors: *Storage capacity, *Drainage, *Soil
ter movement, *Saturated flow, *Unsaturated
w, Storage coefficient, Drainage engineering,
ater levels, Water table, Mathematical studies,
ays, Soils, Porosity, Permeability.
entifiers: Drainage discharge (Soil water).

scharge curves of drains are used to compute the
rage capacity of soils under natural conditions.
ıe drying part of the curve, when the effect of
ecipitation has stopped, and the hydrological
ater balance are considered. The field tests were
rformed on clay soils with low permeability and
loamy soils with moderate permeability. An im-
rmeable layer was at a short distance from the
ains. The storage capacity was constant as long as
e height of the water table remains more than 18
n above the drains. The values obtained in this
ay are clearly smaller than the values obtained
om the difference between saturation and field
ıpacity. (See also W70-09713 and W70-09568
ıru W70-09592) (Knapp-USGS)
70-09712

**FFECT OF CAPILLARITY ON DISCHARGE
F WATER IN PERMEABLE AQUIFERS CON-
INED BY ROCKS WITH SMALL IN-
ERSTICES (FRENCH),**
or primary bibliographic entry see Field 02F.
70-09713

RANSPIRATION OF SUGAR BEET,
esearch Inst. of Irrigation Management,
ratislava (Czechoslovakia).
or primary bibliographic entry see Field 02D.
70-09714

**ION-ISOTHERMAL MOISTURE TRANSFER IN
NSATURATED SOILS,**
. V. Nerpin, and A. M. Globus.
rench resume. In: Water in the Unsaturated Zone,
ol II, Proceedings of the Wageningen Symposium,
he Netherlands, June 19-25, 1966, International
ssociation of Scientific Hydrology, Publication
o 83, p 761-772, 1968. 12 p, 5 fig, 1 tab, 21 ref.

escriptors: *Soil water movement, *Diffusion,
lass transfer, Energy transfer, Osmosis, Freezing,
apillary action, Heat transfer, Convection,
vaporation, Thermodynamic behavior, Soil
hysics, Soil chemistry, Temperature.
dentifiers: *Thermal moisture transfer.

In moist soils where temperature gradients exist, the following mechanisms of thermal moisture transfer can be active: (1) Vapor convection; (2) Vapor diffusion; (3) Vapor thermal slipping; (4) Thermo-capillary flow; (5) Thermo-capillary film flow; (6) Liquid transfer induced by changing volume of entrapped gas due to the change of temperature; (7) Thermo-selfdiffusion of water; (8) Thermo-osmosis of liquid; (9) Combined vapor-liquid transfer including the interaction between liquid and vapor within pores of a soil. When the soil freezes another mechanism is induced by the liquid-to-ice phase transition and by the changes in the moisture potential of the system. When investigating thermal moisture transfer it is important first of all to estimate the relative importance of vapor and liquid transient transfers because this determines the magnitude of related heat flow, the transfer of dissolved matter, and the methods of regulating thermal moisture transfer. (See also W70-09716 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09715

INFLUENCE OF FREEZING AND THAWING OUT PROCESSES ON MIGRATION AND SOIL MOISTURE CONTENT IN THE UPPER LAYERS OF THE UNSATURATED ZONE,
Hydrometeorological Research Center, Moscow (USSR).
L. A. Razoumova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 772-780, 1968. 9 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Soil water movement, *Freezing, Capillary action, Capillary water, Percolation, Diffusion, Temperature, Moisture content, Moisture tension, Unsaturated flow.
Identifiers: Soil water movement (Freezing).

Soil samples were chilled from above to study the movement of water under freezing conditons. Moisture moved to the freezing front until the moisture content in the unfrozen source zone reached about 20%, near the moisture tension of capillary bond rupture. When the source zone was connected to a supply of water simulating a water table, moisture moved into the freezing zone until moisture content exceeded 103% of the thawed saturation value. (See also W70-09717 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09716

MOVEMENT OF MOISTURE AS A LIQUID AND VAPOUR IN SOILS OF SEMI-DESERTS,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
M. M. Abramova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 781-789, 1968. 9 p, 2 fig, 7 tab, 9 ref.

Descriptors: *Soil water movement, *Mass transfer, *Diffusion, *Water vapor, *Drying, Condensation, Evaporation, Water circulation, Energy gradient, Energy transfer, Solutes, Aqueous solutions.
Identifiers: Water vapor transfer, Soil water vapor, Temperature gradient.

During evaporation from wetted soil, liquid moisture moves towards the evaporating layer. As this movement proceeds there is a partial return of moisture as vapor into the deeper layers. The direction of this movement is opposite to the temperature gradient. There is a condensation of this moisture in these cooler layers, and liquid moisture again starts moving to the evaporation surface. Such a circulation of moisture is accompanied by a movement of salts to the surface layers (if they are present in the soil solution). This leads to a 'desalting' of the soil in the condensation zone. The thickness of the condensation zone is determined by the diurnal amplitude of soil temperature. 'Seasonal' vapor movement due to the temperature gradient proceeds in the whole of the soil strata, possibly up to the layer with a constant temperature. The downward transfer of vapor in summer proceed until the wilting point is achieved. The latter is the lower limit of soil moisture content in all cases, excluding the surface layer, even if the temperature gradient is operative. The drying of soil by roots to the lower limit wilting point results in vapor unsaturation of soil air. This phenomenon gives rise to vapor transfer towards this dry zone, independent of the direction of the temperature gradient. Plants in semideserts may grow for a long time after all the available moisture in the root zone has been exhausted. Apparently plants are supplied with moisture which has been transferred into the drying zone as vapor and became liquid. The existence of such a vapor transfer, independent of the direction of the temperature gradient, was demonstrated by experiments. (See also W70-09718 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09717

SOIL MOISTURE DISTRIBUTION FUNCTION IN NON-ISOTHERMIC CONDITIONS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. of Hydrology and Hydraulics.
Julius Sutor.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 790-800, 1968. 11 p, 8 fig, 19 ref.

Descriptors: *Soil water movement, *Diffusion, Energy transfer, Mass transfer, Percolation, Convection, Capillary action, Laboratory tests, Permeameters, Soil physical properties.
Identifiers: Temperature gradients, Thermal soil moisture distribution function.

In order to evaluate the influence of daily and seasonal temperature fluctuations on the movement of soil water, it is necessary to know the physical quantities describing the quantitative and qualitative influence of temperature gradients upon moisture movement. The influence of the temperature gradient upon the movement of soil profile moisture, in addition to other quantities, can be expressed using the experimentally determined moisture distribution function along the applied temperature gradient. To obtain this function clay soil was chosen and an experimental closed system method was used. The curve of moisture distribution in a soil sample assumed characteristic symmetrical shapes. The mathematical analysis of these results showed that for a closed systems the curve of moisture distribution along the applied temperature gradient could be expressed within experimental error by a cubic equation. The choice of this function was verified by comparing quantitative transfer indicators of experimentally obtained values with those calculated from the function. (See also W70-09719 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09718

RELATIONSHIP BETWEEN INFILTRATION AND GROUNDWATER HOUSEHOLD,
National Water Authority, Budapest (Hungary).
G. Kovacs.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 801-809, 1968. 9 p, 4 fig.

Descriptors: *Recharge, *Groundwater movement, *Soil water movement, Flow, Saturated flow, Unsaturated flow, Capillary action, Mathematical studies, Darcys law, Permeability, Infiltration, Hydrologic budget, Water table, Water levels.
Identifiers: Soil water-groundwater relationships.

In the unsaturated layer overlying the groundwater table water movement is influenced by gravity and adhesion. Effects of these two processes are added together concerning the groundwater space. The infiltrating recharge and water loss by evaporation

are related to the depth of the groundwater table. The difference of these two effects is determined by the characteristic curve of the groundwater regime as a function of the average depth of the groundwater. Because the difference is equal to the sum of all other effects, the water regime of the groundwater space can also be characterized by the average depth. A relationship can be found between the depth of the groundwater table and groundwater flow. Salinization of soils can also be linked to the groundwater regime. There are some hydraulic and soil science observations which justify the method described, but it is necessary to collect more data to characterize the processes investigated. (See also W70-09720 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09719

THE METHOD OF GROUNDWATER RECHARGE EVALUATION IN SAND DESERT BY INVESTIGATION OF MOISTURE EXCHANGE IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. N. Chubarov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 809-822, 1968. 14 p, 2 fig, 4 tab.

Descriptors: *Recharge, *Soil water movement, *Water vapor, Condensation, Evaporation, Diffusion, Arid lands, Sands, Moisture content, Convection, Hymidity, Moisture tension.
Identifiers: Soil water-groundwater relationships.

Study of the moisture content distribution through depth in the zone of aeration in small areas of sands covered with vegetation in the desert showed that this distribution is, even at great soil thicknesses (down to 40 m), a function of the potential of the gravitation field and the capillary potential. According to theoretical and experimental data, relationships are determined by which the moisture content and soil moisture conductivity coefficient respectively may be calculated. The relationships determined allow a series of moisture content curves to be calculated by which the direction and value of moisture flow in the zone of aeration may be determined. Comparison of a moisture curve obtained for small areas of barkhan sands showed that groundwater is recharged by atmospheric moisture at a rate of 10-20 mm per year. Supposition of the 'critical' moisture contents on the curve shows that the groundwater evaporation at the expense of liquid transportation under the conditions of sand deserts cannot occur at depths of more than 3 meters to the groundwater. Absence of the groundwater distribution elements at depths of more than 12-14 m (besides the diffusion process of 'underground' evaporation) accounts for the fact that the groundwater in the desert, as a rule, occurs at more 'critical' depths (more than 14 m) and is alinized to a smaller degree. (See also W70-09721 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09720

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02D.
W70-09721

THE TYPE SECTIONS OF ROCK MOISTURE IN THE ZONE OF AERATION AND ESTIMATION OF INFILTRATION VALUES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. S. Markelova, N. A. Ogilvy, and V. N. Chubarov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 827-840, 1968. 14 p, 6 fig, 15 ref.

Descriptors: *Infiltration, *Recharge, *Soil moisture, Soil water movement, Groundwater movement, Mathematical studies, Percolation, Surveys, Permeability, Moisture content, Field capacity, Porosity, Capillary water, Model studies, Mathematical models.
Identifiers: *Soil water-groundwater relationships.

If the zone of aeration is very thick, 3 subzones are distinquished in it having different characters of rock moisture content. A subzone in which the rock moisture content varies with depth as well as with time is situated at the top. With depth, moisture fluctuations fade and the upper subzone turns into that of quasi-stationary moisture. The latter in turn is replaced by the capillary fringe of groundwater. If the thickness of the zone of aeration is small, the middle subzone of quasi-stationary rock moisture may disappear and the capillary fringe will come into contact with the upper subzone of variable moisture or reach the ground surface. In uniform rocks, the moisture content in the middle subzone is constant and depends on the lithological composition of the rocks and infiltration rate. In heterogeneous rocks, each lithologically different layer has its own moisture content which corresponds to the infiltration rate under the given conditions. The infiltration rate is related to the natural rock moisture content and miximum moisture capacity by an exponential function. The relationships established allow the infiltration rate to be estimated by determining the rock moisture content in the subzone of quasi-stationary moisture. Furthermore, the infiltration rate may be determined using the water reserves in the upper soil layer. Using the data on these water reserves found in aqroclimatic reference books, average infiltration values were calculated for different regions of the European part of the USSR. Infiltration varies from 100 to 20 mm per year from north to south and agrees with the determinations made by Kudelin using river runoff analyses. (See also W70-09568 thru W70-09592) (Knapp-USGS)
W70-09722

INFILTRATION AS A FACTOR AFFECTING RUNOFF COMPUTATIONS,
Prague Agricultural Univ. (Czechoslovakia).
Jan Dvorak, and Jaromir Nemec.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 840-845, 1968. 6 p, 1 fig, 2 tab, 11 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Runoff forecasting, Flood forecasting, Mathematical models, Synthetic hydrology, Permeability, Duration curves, Rainfall intensity, Soil water movement.
Identifiers: Czechoslovakia.

Analysis of infiltration is used by hydrologists for the computation of runoff. On small elementary runoff plots infiltration curves are derived. The influence of soil type, slope and rain intensity on parameters of such a curve are expressed mathematically and discussed. From data of a small experimental watershed, infiltration characteristics are derived, and the influence of rain intensity on the infiltration index is ascertained. (See also W70-09724 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09723

AN ESTIMATION OF MOISTURE DYNAMICS IN THE ZONE OF AERATION AND GROUNDWATER RECHARGE BY THE HEAT-MOISTURE TRANSFER,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
V. J. Ljalko.
French resume. In: Water in the Unsaturated Zo
Vol II, Proceedings of the Wageningen Symposiu
The Netherlands, June 19-25, 1966, Internatio
Association of Scientific Hydrology, Publicati
No 83, p 845-851, 1968. 7 p.

Descriptors: *Soil water movement, *Heat flo
*Convection, Water vapor, Hydrographs, Lysim
ters, Diffusion, Energy transfer, Mass transfer, H
midity, Recharge.
Identifiers: Thermal gradients, Ukraine.

A discussion of the heat-moisture transfer theory
given in its application for the calculation
groundwater recharge. The estimates calculated
this method for the Askania-Nova, Czechoslovak
are compared with measurements obtained fro
the underground hydrograph and with results c
tained from lysimeters. The difference between t
three independent methods is less of variou
questions related to water economy. (See al
W70-09725 and W70-09568 and W70-09592) (
napp-USGS)
W70-09724

**USE OF THE HYDRO-INTEGRATOR FOR STU
DYING THE FIRST STAGE OF FILTRATIO
FROM IRRIGATION CANALS,**
All-Union Scientific Research Institute f
Hydrotechnics and Reclamation, Moscow (USSR
M. G. Kaltagova, and V. N. Korenev.
French resume. In: Water in the Unsaturated Zon
Vol II, Proceedings of the Wageningen Symposiu
The Netherlands, June 19-25, 1966, Internation
Association of Scientific Hydrology, Publicatio
No 83, p 865-874, 1968. 10 p, 4 fig, 5 ref.

Descriptors: *Canal seepage, *Infiltratio
*Hydraulic models, Equations, Soil water mov
ment, Percolation, Model studies, Groundwat
movement, Flow, Porous media.
Identifiers: USSR.

The majority of irrigation canals are canals
periodical action, and for such canals water losse
at the first stage of filtration and correct determina
tion of filtration contours are of great importance
The use of a differential equation of infiltration t
solve canal seepage problems is discussed.
hydraulic model (the hydro-integrator) was con
structed to study seepage and infiltration problem
The All-Union Institute of Hydraulic Engineerin
and Melioration has carried out investigations o
the first stage of filtration for canals varying in siz
and running in homogeneous, non-connected
isotropic soil conditions. The filtration contou
lines do not depend on permeability and water ab
sorption factors of the soil. Changing of the latte
will accelerate or slow down movement of the fil
tration front. The canal width on the bottom has n
effect on the value and form of lateral spreading
this being dependent on the depth of water filling i
the canal and on the disposition of the groundwate
level. (See also W70-09726 and W70-09568 thr
W70-09592) (Knapp-USGS)
W70-09725

**FORMATION OF INFILTRATION FLOW
FROM CANAL UNDER DEEP OCCURRENCE
OF GROUNDWATER,**
All-Union Scientific and Research Institute o
Hydrotechnics and Reclamation, Moscow (USSR).
S. A. Guirshkan, I. P. Mochalov, and V. E. Raynin.
French resume. In: Water in the Unsaturated Zone
Vol II, Proceedings of the Wageningen Symposium
The Netherlands, June 19-25, 1966, International
Association of Scientific Hydrology, Publication
No 83, p 874-879, 1968. 6 p, 2 fig.

Descriptors: *Unsaturated flow, *Canal seepage,
Infiltration, On-site tests, Capillary water, Ground-
water movement, Soil water movement, Saturated
flow, Pore pressure, Nuclear moisture meters.
Identifiers: USSR.

Infiltration from a canal into a thick soil strata
above deep groundwater is discussed. In

terogenous flow, the main moving phases are ater and pore air. The pore air is displaced by in-tration water until the infiltration zone is formed d the movement becomes stabilized. To study e physical picture of infiltration from the canal ld, experiments were carried out on a test soil olodnaya Steppe, Uzbekistan) using systematic servation of infiltration from experimental nals. Groundwater was at a depth of 20 m in am of the loess type, interlaid with sandy soils of fferent density. Infiltration rate, formation of the filtration zone before and after contacting the pillary edge of the groundwater, saturation of the rous space with water, and distribution of pres-re in the infiltration flow zone were observed. A utron moisture meter, designed at the All-Union ientific Research Institute, Hydraulic Engineer-g and Melioration, named after Kostiakov, was ed for this purpose. As the moistening front sses through the soil, saturation increases nevenly, which confirms experimentally the ex-tence of a saturation jump at the border of dis-acement of the porous air by infiltration water. See also W70-09727 and W70-09568 thru W70-9592) (Knapp-USGS)
770-09726

RTIFICIAL RECHARGE OF SUBTERRANEAN QUIFERS,
kademiya Nauk SSSR, Moscow. Institut Geologii udnykh Mestorozhdenii, Petrografii, Mineralogii i eokhimii.
or primary bibliographic entry see Field 04B.
V70-09727

RTIFICIAL RECHARGE FOR GROUND-VATER STORAGE IN THE UNSATURATED ONE,
ood and Agricultural Organization of the United Nations, Rome (Italy).
or primary bibliographic entry see Field 04B.
V70-09728

GROUNDWATER POTENTIAL AND SCOPE OF STUDY OF WATER MOVEMENT IN UNSATURATED ZONE IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Faiz Ahmed.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 886-895, 1968. 10 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Infiltration, *Drainage, *Unsaturated flow, Recharge, Soil water movement, Hydrologic budget, Evapotranspiration, Water balance, Water levels, Water resources development, Water resources, Groundwater.
Identifiers: *Pakistan.

The work and studies in East Pakistan have so far been confined to the occurrence of surface and groundwater with little or no regard to the unsaturated zone between the land surface and saturated earth materials. This zone has a significant influence on the distribution of both surface and groundwater, especially in a country where the river system drains one of the heaviest rainfall areas in the world. Moreover 80% of this precipitation occurs during the monsoon months from June to September, when at least 25% of the country is flooded, high humidity persists and the maximum temperature stays about 90 deg F. Water balance study thus is a unique problem. The dynamic effects on the water distribution by hydrologic processes in the unsaturated zone should be considered in evaluating the total water resources of the country. The movement of this water, particularly the rate, as well as the importance of this water to evapotranspiration, drainage for agricultural productivity and its contribution to groundwater reservoir is estimated. (See also W70-09730 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09729

HORIZONTAL SEEPAGE THROUGH UNCONFINED AQUIFERS TAKING INTO ACCOUNT FLOW IN THE CAPILLARY FRINGE,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. G. Youngs.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 897-905, 1968. 9 p, 4 fig, 7 ref.

Descriptors: *Groundwater movement, *Mathematical studies, Infiltration, Seepage, Recharge, Flow, Porous media, Saturated flow, Water table, Darcys law, Soil water movement.
Identifiers: Groundwater flow equations.

Equations are given to calculate the horizontal component of groundwater movement between the top of the capillary fringe and a horizontal impermeable bottom boundary of an aquifer with a free water surface. Also considered are seepage through dams and drainage to ditches. Because infiltration flow is nearly vertical, total horizontal seepage may be considered to take place in the saturated flow region. (See also W70-09731 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09730

SOME OBSERVATIONS ON FLOW IN THE CAPILLARY FRINGE,
J. N. Luthin.
Text in English; French resume included. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, pp 905-909, 1968. 5 p, 1 fig, 1 tab, 11 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Capillary fringe, *Computer models, Mathematical studies, Soil moisture, Hydraulic conductivity, Capillary conductivity, Percolation, Pore pressure, Unsaturated flow.
Identifiers: Capillary fringe movement.

A discussion if given of the effect of the capillary fringe on groundwater flow. It appears that the influence of the capillary fringe can be taken into account in calculations made with a computer, when the relationship between capillary conductivity and soil moisture content is known. For the steady state situation the modified form of the Laplace equation can be used satisfactorily in the computer for obtaining flow nets and flow into a facility or through some porous media. However, for the transient problem the situation is by no means clear. The computer relies upon some known relationship between the capillary conductivity of the soil and some other soil property that emergesfrom the solution. The relationship between the capillary conductivity and the soil moisture content must be inserted into the procedure in order to obtain a satisfactory solution. (See also W70-09708 and W70-09568 thru W70-09592). (Knapp-USGS)
W70-09731

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
Miscellaneous Reprints 78, Plant and Soil, III, 2, April 1969, p 161-182. 22 p, 7 fig, 3 tab, 4 ref.

Descriptors: *Mathematical models, *Soil surveys, Nitrogen, *Computer programs, *Linear programming, *Growth rates.

A mathematical model was constructed for estimating crops yield, with the largest possible general significance for complex interaction of favorable and adverse factors. The model was constructed in order to have available a means of analyzing effects of growth factors which were less manageable than fertilizers, as is the case with the factors dependent on the water management. The growth equation formulated was described by a linear relation of mass flow, diffusion and root activity. The growth model was based on four hypotheses dealing with the stresses occurring in the plant in case of a non-harmoneous uptake of nutrients. In the growth equation a model for two factors were constructed. For the first factor the change in level of fertility of the soil after repeated applications of fertilizer was inserted. The second step was the construction of the part of the formula accounting for the adverse influence of high nitrogen applications. Five unknowns were determined and a first approximation obtained by a geographical solution. Results for nitrogen, phosphate, and potassium applications were given as well as a discussion of the effect unknown factors would have. The first model constructed used computers. The construction of the model was discussed step-by-step to show that at any separate point the relevant biological knowledge can be formulated and given its proper place. (Kriss-Cornell)
W70-09820

EFFECT OF THE SOL-GEL TRANSFORMATION IN CLAY-WATER SYSTEMS ON BIOLOGICAL ACTIVITY: 2. SODIUM UPTAKE BY CORN SEEDLINGS,
Pennsylvania State Univ., University Park. Dept. of Soil Science; and Purdue Univ., Lafayette, Ind. Dept. of Soil Chemistry.
For primary bibliographic entry see Field 02I.
W70-09842

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W70-09850

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
For primary bibliographic entry see Field 02F.
W70-09887

INFILTRATION EQUATIONS FROM RATE-OF-ADVANCE DATA,
Saskatchewan Univ., Saskatoon.
Donald I. Norum, and Don M. Gray.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 111-119, June 1970. 9 p, 2 fig, 13 ref, 2 append.

Descriptors: *Infiltration, Irrigation, *Infiltrometers, Groundwater movement, Permeability, Seepage, Coefficients, *Border irrigation, Irrigation water, *Equations, Canal seepage.
Identifiers: *Infiltration rate, *Irrigation advance, Flow depth.

A method was developed for determining infiltration equations from rate-of-advance data using solutions of the Lewis-Milne border irrigation equation, plotted in dimensionless form on logarithmic paper. Rate-of-advance data were superimposed on the solutions and the coefficients determined from the matching factors for the best fit curve. The basic assumption was that the depth of flow on the surface is constant. If sufficient data are available, the technique can be extended to determine the average depth of flow on the surface. (USBR)
W70-09930

SOILS AND THE MAINTENANCE OF THEIR FERTILITY AS FACTORS AFFECTING THE CHOICE OF USE OF LAND,
G. Aubert.

In Use and Conservation of the Biosphere, p 47-69, Unesco, Paris, 1969.

Descriptors: *Soil physical properties, *Soil chemical properties, *Soil conservation, *Fertility, *Soil environment, Soil aggregates, Soil analysis, Soil engineering, Soil erosion, Soil horizons, Soil microbiology, Soil moisture, Soil properties, Soil stabilization, Soil treatment, Soil water, Soil water movement, Soil-water-plant relationships, Agriculture, Forestry, Irrigation effects, Arid lands, Tropical regions.
Identifiers: *Agricultural practices, *Temperate zones.

With increases in world populations, soil productivities have been subjected to various pressures. The various productive uses of soils are outlined with emphases on agriculture and its counterpart, forestry. The concept of soil fertility and the difficulties in defining and measuring it are considered. Probably no human activity is as destructive to the whole spectrum of soil physico-chemical and biotic properties as agriculture. The most prominent problems are: (1) During early cultivation, root system changes, ploughing and irrigation alter the physical properties of the soil (2) Wind and water erosion overcome pedogenic factors, decreasing soil depths (3) Subsequent dessication, soil Na build-up and differential upper horizon erosion decreases fertility (4) Deteriorating oxidation-reduction conditions occur, particularly as results of irrigation (5) Soil nutrients may decrease, also lowering fertility (6) Leaching, with subsequent effects on soil salinity. Examples of these problems are drawn from all parts of the world, and methods of ameliorating their effects are outlined. Views of proper national resource utilization in terms of total national and world economics are advanced. It is argued that forms of soil resource development, both in time and space, must be rationally considered and the options carefully examined. (Casey-Arizona)
W70-09956

2H. Lakes

COASTAL ENTRAPMENT IN LAKE HURON,
Waterloo Univ. (Ontario).
G. T. Csanady.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 8 fig, 1 ref.

Descriptors: *Lake Huron, *Water circulation, *Cooling water, Nuclear powerplants, Mixing, Fluorescence, Dye releases, Bays, Diffusion, Water temperature, Pumping plants.
Identifiers: Concentration, Slick, Waterloo (Ontario, Canada).

In Lake Huron at Douglas Point, a study was made of the water exchange mechanism between the shore zone and the main mass of the lake. Earlier experiments had shown a tendency for the tagged cooling water of the Douglas Point Nuclear Power Station to remain trapped in the shore zone shuttling back and forth parallel to the shore. A saturation run was envisaged, consisting of a continuous discharge of Thodamine B dye for a period of some three weeks. After continuous sampling and fluorometric observations during these three weeks, it was concluded that no dye concentration build-up was observed except dye retention to a very minor extent in bays and other sheltered pockets of water. Owing to the fortunate choice of location near a dynamically active part of Lake Huron, the cooling water efflux from the Douglas Point station mixes readily with the main lake mass, so that no long-term build-up of concentrations need be feared. On a short-term basis, shore concentrations in the vicinity of the station can be almost as high as concentrations in the efflux. (Osborne-Vanderbilt)
W70-09606

VARABILITY OF WINTERKILL SURVIVAL IN FISHES,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05C.
W70-09671

MAGNITUDE OF WAVES ON LAKE BUTTE DES MORTS AND THEIR EFFECT ON LAKE DEPTH AND SEDIMENT DISTRIBUTION,
Wisconsin State Univ., Oshkoch. Limnology Lab.
Samuel S. Harrison.
Available from the NTIS as PB-194 055, $3.00 in paper copy, $0.65 in microfiche. Report of Investigations No. 2, August 1970. 45 p, 2 tab, 15 fig, 3 ref. OWRR Project A-027-WISC (1).

Descriptors: *Waves (Water), *Sediment transport, Beach erosion, *Bottom sediments, Mud-water interfaces, Lake beds, Limnology, *Sedimentation rates, Weather data, Wisconsin.
Identifiers: Lake Butte des Morts.

The relationship between wind speed and the height, wave length, and period of waves occurring on Lake Butte des Morts was established from field data collected during the summers of 1969 and 1970. Using this relationship, an estimate was made of the frequency of occurrence of waves of various magnitudes on the lake. A chart was constructed so that the orbital diameter and orbital velocity of water moving over the lake bed in response to waves of known magnitude in a known depth of water can be determined. Threshold-orbital-velocity curves for sand-size sediment are superimposed on the chart. The upper half of the Lake Butte des Morts is four to five feet deep. Because waves are of sufficient magnitude to move fine sand on an average of about 40 days per year, and coarse sand about 8 days per year in the upper end of the lake, the depth of this part of the lake is thought to be wave controlled. It is doubtful, however, that waves reach a magnitude sufficient to move the fine-grained organic-rich sediment in the lower end of the lake which is 8 to 9 feet deep.
W70-09672

DEPOSITIONAL ENVIRONMENTS OF LAKE SUPERIOR SANDS THROUGH GRAIN SIZE ANALYSIS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 02J.
W70-09673

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 02J.
W70-09675

EVALUATION OF GRAIN-SIZE PARAMETERS IN LACUSTRINE ENVIRONMENTS,
Computer Data Processors Ltd., Calgary (Alberta); and Calgary Univ. (Alberta). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-09693

BOTTOM SEDIMENTS OF LAKE MANAZALAH, EGYPT,
Alexandria Univ. (Egypt). Dept. of Oceanography; and Institute of Oceanography, Alexandria (Egypt).
Saad K. El-Wakeel, and Saad D. Wahby.
Journal of Sedimentary Petrology, Vol 40, No 1, p 480-496, March 1970. 17 p, 6 fig, 3 tab, 48 ref.

Descriptors: *Bottom sediments, *Lakes, *Deltas, Phosphorus, Organic matter, Particle size, Sands, Silts, Clays, Sedimentation.
Identifiers: *Nile River, Egypt.

Lake Manzalah is the largest of the Delta Lakes Egypt. Grab samples were collected from the bo tom of the lake and subjected to mechanical a chemical analysis. The majority of samples badly sorted with an average median diameter 85.6 microns. The predominant type of sedime covering the bottom the lake is the complex ty sand-silt-clay followed in abundance by the clay sand and silty clay. There is a basinward increase grain size of sediments. The average carbona content is 34.88% and its distribution on the bo tom generally follows the same pattern of the gra size distribution of sediments. The average organ matter content is 2.56% whereas the organ matter content increases with the decrease of me an diameter of grains. The C:N ratio rang between 5 and 17 with an average of 9.7. T average phosphorous content is 0.056%. T phosphorous content increases with the decrease median diameter of grains. Available ferric iron sediments ranges betwee 0.2 and 3% with average of 1%. Interrelations between the gra size, carbonate, organic matter, phosphorous a available iron are discussed. (Knapp-USGS)
W70-09699

DETECTION OF UPWARD PERCOLATION SALINE LAKE WATER,
Weizmann Inst. of Science, Rehovoth (Israel); a Water Planning for Israel, Tel Aviv. Hydrologic Branch.
C. J. Braudo, F. Mero, and A. Mercado.
ASCE Proceedings, Journal of the Hydraulics Di sion, Vol 96, No HY9, Paper 7519, p 1795-180 September 1970. 8 p, 5 fig, 4 ref.

Descriptors: *Salinity, *Lakes, *Water pollutio sources, *Percolation, Seepage, Groundwat movement, Saline water systems, Saline water i trusion, Radioactivity, Tracers, Water chemistr Mixing.
Identifiers: Lake Kinneret (Israel).

A method for detecting and locating sources saline water percolating through the bottom Lake Kinneret, Israel, is described. The method based on the fact that the salinity of the springs the area described is accompanied by natur radioactivity. A large area was monitored fo radioactivity and areas were selected for detailed measurements of the salinity of the mud. Dire flow measurements are used to determine the co tribution of the sources to the salinity of the lak (Knapp-USGS)
W70-09838

WATER WAVES GENERATED BY LAND SLIDES IN RESERVOIRS,
California Univ., Berkeley. Dept. of Civil Engineer ing.
Robert L. Wiegel, Edward K. Noda, Edward M. Kuba, Dennis M. Gee, and Gordon F. Tornberg.
ASCE Proceedings, Journal of the Waterways an Harbors Division, Vol 96, No WW2, Paper 7279, 307-333, May 1970. 27 p, 25 fig, 25 ref, appen State of California, Dept of Water Resources, Stan dard Agreement No. 455494.

Descriptors: *Waves (Water), *Landslides *Reservoirs, *Tsunamis, *Hydraulic models Mathematical models, Model studies, Bores.
Identifiers: Wave runup, Landslide waves.

Results of hydraulic laboratory tests of an idealized rockfall are presented, with the main parameters being the ratio of rockfall width to water depth an a Froude number. For a large range of these two parameters, a linear theory for the generation water waves by a similar mechanism is useful as guide to interpreting the results. For large values o the two parameters, the linear theory is a margina usefulness. It is shown by means of the results o two similar tests, with a geometric scale ratio o 1:4, that a small model test can be used to predic the results to be expected from a large model tes even in the range where bores form, provided the velocity time histories of the falling rock are similar. (Knapp-USGS)

70-09839

RELIMINARY OBSERVATIONS OF THE YDROMECHANICS, NUTRIENT CYCLES ND EUTROPHICATION STATUS OF LAKE INNERET (LAKE TIBERIAS),
mnological Lab., Tabigha (Israel).
Serruya, S. Serruya, and T. Berman.
erhandlungen der Internationalen Vereinigung r Theoretische und Angewandte Limnologie, Vol , p 342-351, 1969. 7 fig, 1 tab, 8 ref.

escriptors: *Cycling nutrients, *Eutrophication, Hydrodynamics, Lakes, Internal water, Waves Water), Diurnal, Epilimnion, Winds, Thermocline, Temperature, Currents (Water), ypolimnion, Algae, Nitrogen, Phosphorus, Oxgen, Carbon, Enzymes, Sampling, Bottom sediments, Sodium, Potassium, Iron, Manganese, Calcium, Pigments.
dentifiers: *Lake Kinneret (Israel).

xistence of internal waves in Lake Kinneret Israel) was confirmed. In early May 1968, with ell developed thermocline, characteristic internal aves were observed, averaging 11 hours, occurring regularly at semi-diurnal intervals, correlated omewhat with periodic west wind. In the hypolimion, large quantities of ammonium-nitrogen and rthophosphate concentrations increasingly accumulated from May to December. Ratio of total vailable nitrogen to orthophosphates is high in ebruary and decreases rapidly to mid-summer. ssimilation rate and regeneration in epilimnion is bout four times greater in spring than summer. nder prevailing lake conditions, during the ecomposition of organic matter in hypolimnion, or every phosphorus atom liberated as phosphate, 80 atoms of oxygen are used for oxidation of corresponding total quantity of organic matter. Study of the epolimnion strongly suggests that the high oxygen:phosphorus ratio reflects the high organic content of lake algae and particularly their high nitrogen:phosphorus ratio. High level of organic matter indicates that sediments are providing quantities of nutrients, particularly ammonium-nitrogen. Biweekly samples of alkaline monophosphoesterases are measured. In bottom deposits, content of organic carbon and Kjeldahl nitrogen is rather high. There are indications of recent enhanced eutrophication, supported by results of pigment extraction from sediments. (Jones-Wisconsin)
W70-09889

HOLOMIXY AND OLIGOMIXY IN LAKE MAGGIORE: INFERENCE ON THE VERTICAL DISTRIBUTION OF ZOOPLANKTON,
Livia Tonolli.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 231-236, 1969. 1 fig, 2 tab, 9 ref.

Descriptors: *Lakes, *Zooplankton, *Distribution patterns, Oligotrophy, Temperature, Winds, Copepods, Rotifers, Seasonal, Dissolved oxygen, Chemicals, Algae, Migration, Profundal zone.
Identifiers: *Holomixy, *Oligomixy, *Lake Maggiore (Italy), *Vertical distribution, Cladocerans, Mixodiaptomus laciniatus, Eudiaptomus vulgaris, Cyclops abyssorum, Cyclops landei, Mesocyclops leuckarti, Megacyclops viridias, Heterocope saliens.

Every five-seven years there is a complete overturn of Lake Maggiore (Italy) waters. This study records zooplankton distribution from surface to maximum depth. During the holomictic winter, a progressive decrease of copepod densities in upper 50 meters occurred from January to the end of March, with an increase in deeper layers. These individuals, overturned during winter holomixy to the deepest layers, could not find enough food in those layers for energy to reach water layers more suitable from a trophical point of view. This upward effort is affected by complete lack of vertical gradients in the ecological parameters, as determined by the holomixy, and zooplankton does not generally move straight upward from deep to superficial waters. During the overturn, the deepest layers are recharged with oxygen. Nutrients, concentrated in deep water, are suddenly brought in high concentrations to the more superficial layers and abruptly made available for algal development, exactly when zooplankton feeders are numerically depressed. After full circulation, spring 1963, there was an algal surplus resulting in nutrient enrichment. Kinetics of an oligomictic lake at winters' ends are responsible for productivity for the year and even for some subsequent years. (Jones-Wisconsin)
W70-09890

NITROGEN DISTRIBUTION IN SOME WISCONSIN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
Dennis R. Keeney, John G. Konrad, and Gordon Chesters.
Journal of the Water Pollution Control Federation, Vol 42, No 3, Part 1, p 411-417, 1970. 3 tab, 20 ref.

Descriptors: *Nitrogen, *Distribution, *Wisconsin, *Lakes, *Sediments, Eutrophication, Phosphorus, Dissolved oxygen, Hypolimnion, Aquatic weeds, Sampling, Oligotrophic, Hardness (Water), Depth, Hydrogen ion concentration, Nitrogen compounds, Soils, Mineralogy, Ammonium compounds, Freeze drying.
Identifiers: Algal blooms, Mesotrophic, Soft water, Lake types, Wisconsin lakes.

Forms and distribution of nitrogen in some Wisconsin lake sediments as function of lake type and trophic level are reported. The distribution (based on total sediment organic nitrogen) of the various forms of nitrogen hydrolyzable by 6N HCl did not differ markedly among sediment samples. No consistent effects of location, water composition, pH, or carbonate content of the sediments were found in the organic-nitrogen distribution data. An average, about 45% of the organic nitrogen in sediments exists as unidentified acid-hydrolyzable and acid-nonhydrolyzable nitrogen. The hard-water lake sediment samples contained greater amounts of fixed ammonium-nitrogen compared with soft-water samples, indicating mineralogical differences. It is impossible, with the limited number of samples, to discern any effects of lake trophic level on the fixed and exchangeable ammonium-nitrogen contents of lake sediments. Similar forms of nitrogen occur in lake sediments as in soils, but the nitrogen distribution differs somewhat. Decrease in hexosamine-nitrogen accompanied by an increase in amino acid-nitrogen with increasing lake fertility level indicates a greater microbial turnover of organic nitrogen in oligotrophic lakes, probably due to the higher dissolved oxygen in the hypolimnionic waters. (Jones-Wisconsin)
W70-09891

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
Howard R. Drew, and John E. Tilton.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 562-572, 1970. 3 fig, 17 ref.

Descriptors: *Reservoirs, *Texas, *Aquatic life, *Thermal water, Temperature, Water quality, Fish, Fisheries, Sampling, Creel census, Bass, Fish management, Channel catfish, Rotenone, Buffalo fishes, Carpsucker, Carp, White bass, Nutrients, Hydroelectric plants, Colorado River, Fishkill, Recreation, Aeration, Epilimnion, Stratification, Sunfishes, Heat transfer.
Identifiers: *Micropterus salmoides, Ictalurus punctatus, Pomoxis annularis, Ictiobus bubalus, Carpiodes carpio, Cyprinus carpio, Dorosoma cepedianum, Dorosoma petenense, Bottom-feeding fauna, Shad, Roccus chrysops.

Thermal requirements for aquatic life that will permit maximum use of Texas' resources are reviewed. Almost all Texas streams and reservoirs have been investigated by water quality studies, creel censuses, and continuous sampling of fish populations. Fish evolution in a newly constructed reservoir follows a pattern of exceptional growth of game fish during the first year or two. The game fish:rough fish ratio inverts after that period. Whereas initially total weight of game fish may exceed 50% of all fish taken, by the fourth or fifth year, coarse or undesirable fish dominate and usually make up about 75% of total nettable fish weight. Two Texas reservoirs, primarily used for cooling of steam electric power generation, have remained highly productive since impoundment and have maintained well-balanced fish populations; in these, no decline in game fish population with reservoir age, such as experienced in other Texas reservoirs, has occurred. This is attributed primarily to the result of water circulation and increased temperatures from the power plant. Operation of the steam electric plant increases the oxygen balance of the whole lake. The large flow of warm water can be an effective fish management tool. (Jones-Wisconsin)
W70-09893

NITROGEN LOSSES FROM ALKALINE WATER IMPOUNDMENTS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 95, No SA2, p 223-231, 1969. 5 fig, 1 tab, 3 ref.

Descriptors: *Alkaline water, *Nitrification, *Nitrogen, Impoundments, Ammonia, Analysis, Analytical techniques, Hydrogen ion concentration, Temperature, Winds, Effluents, Lakes, Surface waters, California.
Identifiers: Elfin Forest Lake (Calif), Gaseous ammonia nitrogen, Degasification.

A method of estimating the loss of gaseous ammonia from alkaline waters consists of analysis of samples from outdoor impounded water subject to mixing by wind. Another method involves the use of a floating cell and acid trap to determine ammonia liberated from an impoundment. The field tests were conducted from June to September in two small California eutrophic impoundments: Elfin Forest Lake with pH 9.5-9.8, and a pH 9.1 effluent pond at the Santee Water Reclamation. The measured rate of loss of ammonia nitrogen for the Elfin Forest Lake was 3.3 milligrams per square foot/day, whereas that for the Santee pond, 9.1 milligrams per square foot/day. The determined values constituted 14% and 22% of the predicted values for these basins, respectively. (Wilde-Wisconsin)
W70-09894

THE SEGREGATION OF THE BENTHIC FAUNA IN SUBALPINE LAKES (IN FRENCH),
Lyon Univ. (France). Faculte des Sciences.
Jacques Wautier, and Jacques Juget.
Bulletin Societe Zoologique de France, Paris, Vol 94, No 2, p 277-284, 1969. 2 fig, 1 plate, 15 ref.

Descriptors: *Benthic fauna, *Lakes, *Ecological distribution, Biological communities, Ecology, Behavior, Speciation, Lake stages, Nematodes, Oligochaetes, Copepods.
Identifiers: Subalpine lakes, Microevolution, Lake Geneva.

Studies of benthic animals revealed that ecological diversity of subalpine lakes plays a decisive role in distribution and introlacustrine evolution of organisms reflected in their morphology and physiology. This is particularly true of Nematoda, Oligochaeta, and Copepoda. Lake Leman (Geneva) with its great depth and the presence of some relic life forms provides an especially noteworthy illustration of the pertinent relationships. (Wilde-Wisconsin)
W70-09898

MAN'S INFLUENCE ON LAKE ERIE,
Southern Illinois Univ., Carbondale. Dept. of Botany.
Jacob Verduin.
The Ohio Journal of Science, Vol 69, No 2, p 65-69, 1969. 1 fig, 2 tab, 12 ref.

Descriptors: *Lake Erie, *Ohio, Swamps, Farms, Silts, Light penetration, Biota, Nutrients, Phosphorus, Oxygen, Sewage effluents, Cisco, Walleye, Seiches, Mayflies, Hydrogen ion concentration, Photosynthesis, Nitrogen, Detergents, Phytoplankton, Benthic fauna, Carbon dioxide, Bloodworms, Yellow perch, Midges.
Identifiers: *Man's influence, Maumee River, Toledo (Ohio), Leucichthys artedi, Esox mosquinongy, Stizostedion vitreum, Hexagenia limbata, Asterionella formosa, Tabellaria fenestrata, Melosira ambigua, Melosira binderana, Fragilaria capucina, Coscinodiscus radiatus, Chironomus plumosus, Perca flavescens, Cladophora glomerata, Great Black Swamp (Ohio).

Conversion of northwestern Ohio's Great Black Swamp to farm land during the last half of the 19th century had a profound, but scantily documented influence on Lake Erie. Silts, once largely filtered by swampland vegetation, were, with the destruction of that vegetation, carried into Lake Erie, reducing light penetration and significantly altering the lake's biota. More recently enhancement of plant nutrients, especially phosphorus, which has increased 5-fold since 1948, has supported nuisance levels of plant growth creating severe oxygen depletion near the lake bottom and responsible for additional major and undesirable changes in species composition of plant and animal communities. The solution to this problem is removal of plant nutrients from the waters before they enter Lake Erie. The 'living filter' treatment, in which sewage plant effluents are filtered through root zones of plant communities, seems most promising. This treatment effectively removes nutrients, converting them to plant products. Another model, where effluent from sewage treatment plants is passed through a series of artificial lakes, processes the effluents effectively so that final-stage lakes are excellent recreational facilities, and the released waters do not burden aquatic environments. (Jones-Wisconsin)
W70-09900

PHOSPHATE IN LAKE KINNERETH,
Ministry of Agriculture, Haifa (Israel). SeaFisheries Research Station.
O. H. Oren, and Rosa Ravid.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 334-341, 1969. 3 fig, 3 tab, 7 ref.

Descriptors: *Lakes, *Phosphates, *Distribution patterns, Seasonal, Diurnal, Phosphorus, Thermocline, Depth, Beds under water, Oxygen, Temperature, Epilimnion, Hot springs, Chlorides, Calcium, Hydrogen ion concentration, Hypolimnion, Phytoplankton.
Identifiers: *Lake Kinnereth (Israel), Vertical distribution, Salt water carrier, Orthophosphates.

Lake Kinnereth (Israel) contains relatively large quantities of orthophosphate as well as total phosphorus which, during most years, are near the bottom--not in the whole hypolimnion. Integrated total quantity of total phosphorus does not change considerably in the whole lake, however the layers, containing phosphorus, do change. Before the end of the seasonal stratification, more than 40% of the total phosphorus is concentrated in the 30-40 meter layer, the minimum of total phosphorus in the 10-20 meter layer. In January, the layer between 30-40 meters is still undistrubed, while mixing has taken place in upper layers. In February a considerable percentage of the total phosphorus is still in the bottom layer, although decreased by 25%; at that time it is mainly found at the surface where spring phytoplankton bloom has begun. During March, minimal quantities of total phosphorus are found near the bottom, maxima at surface and upper layers. The phosphorus content of the lake is decreasing. This preliminary investigation shows the total quantity of orthophosphate has decreased in the four years since the salt water carrier has been in operation; this carrier contains quantities of phosphate and total phosphorus below the Tiberias Hot Springs. (Jones-Wisconsin)
W70-09901

TEMPORAL CHANGES OF PHYSICAL AND CHEMICAL FACTORS IN A SHALLOW ASTATIC SALINE LAKE,
G. E. White, and R. Hartland-Rowe.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 440-446, 1969. 10 fig, 3 ref.

Descriptors: *Saline lakes, *Shallow water, *Physical properties, *Chemical properties, Ecology, Salt tolerant, Grasses, Temporary pond stage, Sampling, Quartz, Clays, Turbidity, Depth, Temperature, Hydrogen ion concentration, Alkalinity, Winds, Dissolved solids, Chlorides, Sulfates, Sodium, Magnesium, Iron, Oxygen, Crustaceans.
Identifiers: *Astatic lakes, Alberta (Canada), Chain Lakes (Canada), Anostraca, Hordeum jubatum, Puccinellia nuttaliana, Distichlis stricta, Chenopodium glaucum, Chenopodium salinum, Suaeda depressa, Scirpus paludosus, Specific conductance, Lepidurus lemmoni, Branchinecta gigas, Branchinecta mackini.

This study was undertaken to gain information on one of the larger temporary saline waters of Alberta and its Anostracan fauna. Wanek Lake, one of the Chain Lakes (Alberta, Canada) lacks any surface outflow but is fed by intermittent streams in the springtime, resulting in a recurrent temporary pool. Its bed is composed of a mixture of rounded quartzite grains and clay and has excessive turbidity. Water depth decreases with time throughout the season. Total mixing is the usual condition in this very shallow lake. Changes in hydrogen ion concentration show a gradual increase during the season mainly due to evaporation. It is a sulphate-carbonate lake, with sodium and magnesium the predominant cations; concentrations of iron were unusually high. Two of the three species of euphyllopod Crustacea occurring in Wanek Lake--Branchinecta gigas and B mackini--were studied. Factors responsible for their disappearance before the lake dired up completely are considered. These preliminary observations on Wanek Lake reveal that we can observe an annual sequence of physical and chemical changes to which certain euphyllopods appear to be especially well adapted. (Jones-Wisconsin)
W70-09902

THE CONDITION OF LAKES AND PONDS IN RELATION TO THE CARRYING OUT OF TREATMENT MEASURES,
For primary bibliographic entry see Field 05C.
W70-09941

2I. Water in Plants

WATER MOVEMENT AND ITS UTILIZATION BY PLANTS UNDER THE DEEP WATER STORAGE IN SOIL BY USING OFF-SEASON IRRIGATION,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09585

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 02G.
W70-09588

EVAPOTRANSPIRATION OF PLANTS AN
FLUCTUATION OF THE GROUNDWATER T
BLE,
State Inst. of Hydrology and Meteorology, Warsa
(Poland). Water Physics Div.
For primary bibliographic entry see Field 02G.
W70-09589

THE INFLUENCE OF VARIOUS AGRICU
TURAL PRACTICES ON SOIL WATER AND I
THE ZONE OF AERATION OF CHERNOZEM
(FRENCH),
For primary bibliographic entry see Field 02G.
W70-09590

EFFECT OF THE SOL-GEL TRANSFORMA
TION IN CLAY-WATER SYSTEMS O
BIOLOGICAL ACTIVITY: 2. SODIUM UPTAK
BY CORN SEEDLINGS,
Pennsylvania State Univ., University Park. Dept. c
Soil Science; and Purdue Univ., Lafayette, Ind
Dept. of Soil Chemistry.
D. E. Baker, and P. F. Low.
Soil Science Society of America Proceedings, Vo
34, No 1, p 49-56, January-February 1970. 8 p,
fig, 2 tab, 24 ref.

Descriptors: *Clays, *Gels, *Soil-water-plant relat
tionships, Ion transport, Ion exchange, Viscosity
Water chemistry.
Identifiers: Clay-water systems.

Homoionic Na- and K0 clay mixtures were
prepared from Wyoming bentonite with water to
produce clay-water systems. These systems were
extruded through a hypodermic needle to orien
the particles. Some of the systems were disturbed
by tapping their containers on the laboratory
bench. The following quantities were measured
viscosity; relative partial molar free energy o
NaCl, KCl and HCl; and water tension. Viscosity
free energy of HCl, and water tension were
decreased by disturbing the clay systems, whereas
the free energies of both NaCl and KCl were in-
creased. Samples of the clay systems were extruded
around the radicles of corn seedlings. Na uptake
was determined by analyzing the seedlings for Na-
22. Na uptake increased curvilinearly with Na-clay
content in the range 0-4% clay and then leveled off.
In the curvilinear range, Na uptake was directly
proportional to the free energy of NaCl. Na uptake
was greater from the disturbed than from the
undisturbed systems. Because the disturbance also
increased the free energy of NaCl, it was concluded
that Na uptake depended on this quality. (Knapp-
USGS)
W70-09842

ESTIMATING THE TRITIUM INPUT TO
GROUNDWATER FROM WINE SAMPLES:
GROUNDWATER AND DIRECT RUN-OFF
CONTRIBUTION TO CENTRAL EUROPEAN
SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches
Institut.
For primary bibliographic entry see Field 02F.
W70-09873

THE EFFECT OF LAND USAGE ON AQUATIC
AND SEMI-AQUATIC VEGETATION AT HIGH
ALTITUDES IN SOUTHERN AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept.
of Botany.
A. Jacot Guillarmod.
Hydrobiologia, Vol 34, No 1, p 3-13, 1969. 1 fig, 9
ref.

Descriptors: *Bogs, *Basalts, *Aquatic plants, *River systems, *Ecology, Conservation, Water flow, Grazing, Mining, Population, Ponds, Pondweeds, Gravels, Springs, Frost heaving.
Identifiers: *Southern Africa, *Lesotho, *Orange river, Kimberlite pipes.

e high altitude areas (7500 feet or greater) of uthern Africa serve as sources of several impor- nt rivers. The climate is harsh and rainfall and owfall are high. The topography is mainly a vered basaltic cap with volcanic vents, doleritic kes and kimberlite fissures. The river source eas lie mainly within the new state of Lesotho. ater flows over the basalt carrying practically no t. The river sources are ancient bogs formed on e highest mountain slopes and shallow valley ads. Most bogs are extensive and contain many rings that well up through kimberlite pipes. The getation forms a dense mat and is largely an- osperms and algae. The bogs therefore serve not ly as river sources, but also as regulators of the gh rainfall, filtering the waters through the gravel d vegetation. Population pressures have created tensified pastoral activities in Lesotho and the gh mountain areas are now being intensively azed. Grazing animals are penetrating into the gs, destroying crucial vegetation. Additionally, amond mining in kimberlite pipes is destroying e springs. The bogs cannot long stand these intru- ons and if they are destroyed, the river systems ill be critically damaged. A plea is made for ra- onal usage planning and regulation of these areas. Casey-Arizona)
W70-09950

GROWTH STIMULATION BY HIGH CHLORIDE CONCENTRATIONS IN HALOPHYTES,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irriga- ion Research.
I. Greenway.
Israel Journal of Botany, Vol 17, No 3, p 169-177, 968. 4 fig, 2 tab, 13 ref.

Descriptors: *Halophytes, *Chlorides, *Cations, *Salt tolerance, *Plant growth, Osmotic pressure, Electrolytes, Salinity, Plant physiology, Soil-water- plant relationships, Calcium, Sodium, Magnesium, Potassium, Plant growth, Turgidity, Water balance.
Identifiers: *Salt-accumulating halophytes, *Salt- excluding haliphytes, *Saltbush, *Australia, Osmotic adjustment.

Seedlings of an Australian desert halophyte, Atriplex nummalaria, were grown in nutrient solu- tions of differing chloride concentrations ranging from 10-300 milliequivalents per liter and with dif- fering cations (K, Ca, Na, Mg). With Na, K and Mg Chlorides growth was optimum at ranges of 100- 200 milliequivalents per liter. Ca chloride caused toxic effects with increasing concentrations, which were largely ameliorated when other cations were present. Increased growth in NaCl solutions was ac- companied by increasing Na and Cl concentration and no changes in assimilation, eliminating sub- stitution of Na with K and increased photosynthetic efficiency as growth factors. Growth comparisons in media with increasing ionic concentrations in- dicate that salt-excluding halophytes suffer from low medium water potential while salt-accumulat- ing halophytes compensate by increasing internal osmotic pressure. It is concluded that appropriate agricultural breeding for accumulation-type characteristics would combine salt tolerance with growth vigor. (Casey-Arizona)
W70-09951

CONVERGENT EVOLUTION OF MEDITER- RANEAN-CLIMATE EVERGREEN SCLEROPHYLL SHRUBS,
Stanford Univ., Calif. Dept. of Biological Sciences.
Harold A. Mooney, and E. Lloyd Dunn.
Evolution, Vol 24, No 2, p 292-303, June, 1970. 5 fig, 2 tab, 57 ref. National Science Foundation grants GB 5223, GB 8148.

Descriptors: *Leaves, *Chaparral, *Shrubs, *Semiarid climates, *Moisture stress, Germination, Soil moisture, Droughts, Root systems, Tempera- ture, Photosynthesis, Stomata, Respiration, Nutrients, Toxicity, Precipitation (Atmospheric), Soil-water-plant relationships.
Identifiers: *Sclerophyllous plants, *Evergreen leaves, *Mediterranean climates, Adaptation, Con- vergence, Annuals (Plants), Leaf drop, Overheat- ing effects, Nutrient deficiencies, Fire damages, Overgrazing, Resprouting, Palatability.

The Mediterranean climatic type (summer drought, winter rain) occurs in 5 diverse, isolated parts of the world. In all areas the native vegetation is similar--a dense scrub dominated by deeprooted woody evergreen sclerophyllous species. The cli- mate is severe with plant life because favorable soil moistures and favorable temperatures are out of phase resulting in only brief periods of vigorous growth. Many other unfavorable factors also exist. It is proposed that the adaptive possibilities of an area vary inversely with environmental stresses, ex- plaining the high degree of vegetative convergence in Mediterranean areas. The development of the evergreen leaf is a result of the greater efficiency. In these climates, plants are prepared to photosynthesize immediately in favorable condi- tions, while surviving drought conditions without leaf shedding. The crucial adaptations are (1) Deep root systems enabling at least some soil moisture utilization throughout the year (2) Small leaves with proportionately greater water conducting tis- sue resulting in reduced desiccation susceptibility (3) Nutrient-gathering and nutrient-conservation mechanisms adapted to low soil nutrient levels in these areas (4) Seedling unpalability and fact resprouting following fires (6) Stem-flow mechanisms which trap and conserve moisture from rain. (Casey-Arizona)
W70-09952

TODAY THE ENVIRONMENT, TOMORROW THE WORLD,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries.
For primary bibliographic entry see Field 06G.
W70-09953

SALT TOLERANCE OF CROPS AT GERMINA- TION STAGE,
Udaipur Univ., (India). Agricultural Experiment Station.
For primary bibliographic entry see Field 03C.
W70-09954

THE PHYSIOLOGY OF DORMANCY AND SUR- VIVAL OF PLANTS IN DESERT ENVIRON- MENTS,
Hebrew Univ., Jerusalem (Israel). Dept. of Soil Science.
D. Koller.
In Symposium of the Society for Experimental Biology, Vol 23, p 449-469. Cambridge University Press, 1969. 7 fig, 9 tab, 36 ref.

Descriptors: *Arid lands, *Germination, *Photoac- tivation, *Temperature control, *Water control, Xerophytes, Semiarid climates, Ecology, Physiological ecology, Plant physiology, Moisture stress, Growth stages, Precipitation.
Identifiers: *Dormancy, *Regeneration buds.

The essential feature of plant dormancy is its rever- sibility under environmental control. In deserts moisture stress is the dominant limiting factor. Plant life is made possible only because rainfall is unevenly distributed in time and space and this is accentuated by soil properties creating differential soil moisture distributions. Since seed dormancy in- volves species survival, there is a universal imposi- tion of regulating mechanisms on seed germination, ensuring it occurs only when survival probability is maximal. Precise sensitivity to ongoing environ- mental factors is therefore necessary and germina- tion regulation is based on: (1) Selectivity of response mechanisms to environmental factors (2) Heterogeneity of germination requirements within the seed population. Selectivity mechanisms mea- sure some combination of light, temperature and moisture. Numerous examples given show various seeds are capable of measuring temperature, their own depth in soil or water, the intensity, spectral composition or periodicity of light, soil water economy and soil physical properties. They may also mearure fluctuations over time, or various combinations, both simultaneous and sequential. Paradoxically, none of the germination regulation mechanisms described occurs solely in desert plants. (Casey-Arizona)
W70-09955

ANNUAL AND PERENNIAL BARRIERS IN RELATION TO WIND EROSION AND MOISTURE CONSERVATION,
Agricultural Research Service, Sidney, Mont.
For primary bibliographic entry see Field 03B.
W70-09957

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09960

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
For primary bibliographic entry see Field 02D.
W70-09964

CHARACTERISTICS OF THE ROOTS OF SOME XEROPHYTES,
New Mexico Univ., Albuquerque, N. Mex. Dept. of Biology.
Howard J. Dittmer.
In: Physiological Systems in Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 231-238, University of New Mexico Press, 1969. 2 fig, 2 tab, 10 ref.

Descriptors: *Xerophytes, *Root systems, *Xylem, *Water conservation, *Soil properties, Arid lands, Bound water, Phreatophytes, Drought tolerance.
Identifiers: *Mycorrhizas, *Root nodules, Tap roots.

There are 4 major types of desert root systems: (1) Storage roots which have relatively thick, water-re- tentive epidermal layers (2) Long tap roots not en- larged into storage roots (3) Relatively large lateral roots confined to the upper few inches of soil (4) Shallow fibrous roots characteristic of grasses. Penetration depths, lateral root development and root densities varies among species and are func- tions of genetic potential and environmental condi- tions. Nearly all desert root systems have mycorr- hizal associations which decrease with soil dryness. Bacterial nodules on leguminous plant roots are also less abundant in arid soils. Drought resistance is mainly due to anatomical adaptations. Desert plants have a higher percentage of root xylem in relation to their diameter than more mesic plants. This results in slower water movement and greater water storage. Additionally, special cortical cells and resinous substances increase bound water con- tent. (Casey-Arizona)
W70-09966

PHYSIOLOGICAL SPECIALIZATIONS OF AM- PHIBIANS TO HABITATS OF VARYING ARIDI- TY,
Minnesota Univ., Minneapolis. Dept. of Zoology.
William D. Schmid.
In: Physiological Systems in Semiarid Environments, Hoff, C. C., and Riedesel, M. L. (editors), University of New Mexico Press, p 135-142, 1969. 1 tab, 31 ref. National Science Foundation Grant GB-6920.

Descriptors: *Water conservation, *Amphibians, *Water balance, *Physiological ecology, *Metabolism, Animal behavior, Respiration, Animal physiology, Urine, Semiarid climates, Arid

lands, Aquatic animals, Xerophilic animals, Sodium, Osmotic pressure.
Identifiers: *Integument, *Urinary bladder, *Active transport, Fossorial animals.

Due to lack of behavioral and microclimatic factors involved in amphibian water conservation, it is necessary to discuss relevant problems on the bases of (1) Whole organisms (2) Integument and urinary bladder organs (3) Nitrogen excretion. Terrestrial species have greater desiccation tolerances and faster recovery from moisture stress than aquatic species. Current evidence suggests great directional rates of water movement in terrestrial species integuments. Behavioral avoidance related to fossorial habits may also be important in many terrestrial species. The skin and the urinary bladder function in the active uptake of Na. The urinary bladder is larger in terrestrial species and functions mainly as a water storage organ, where as it is primarily an excretory organ in aquatic species. Aquatic species excrete ammonia while semi-aquatic and terrestrial species excrete urea, thus avoiding toxic accumulation. The more terrestrial the life form, the greater is the tolerance to hyperosmotic urea. (Casey-Arizona)
W70-09967

BODY COMPOSITION OF THE KANGAROO RAT (DIPODOMYS MERRIAMI),
Nevada Univ., Reno. Desert Research Inst.
Leslie Startin.
In: Physiological Systems In Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 35-44, University of New Mexico Press, Albuquerque, 1969. 3 fig, 2 tab, 3 ref. Supported by Nevada Heart Association and National Science Foundation Grant GB-5217.

Descriptors: *Rodents, *Physiological ecology, *Animal metabolism, *Water balance, Animal physiology, Reproduction, Diets, Ecology, Semiarid climates, Arid lands.
Identifiers: *Kangaroo rat, *Body fluids, *Body solids, *Animal fats, Metabolic water, Mojave Desert.

The kangaroo rat is a nocturnal desert rodent capable of living without drinking water and active in all seasons in the Mojave Desert. Rats were trapped for a year (1967), and analyzed for water content, total body protein and solids, ash, fat and heart composition. Water content increased during the spring then decreased to a constant level for the rest of the year. The increase was correlated with a diet of greens during the primary reproductive period. The water content did not increase during unusually heavy summer rains and resulting greenery, indicating its independence of available environmental water except during periods of high metabolic demand. Total body protein, total body solids, ash and heart composition remained relatively constant over the entire year. Fat content increased in late spring and summer and decreased in fall and winter ranging from 1-9 percent. The generally low fat level is probably an adaptation to a mobile, speed-oriented was of life. Increases in fat content may be correlated with increases in seed consumption, since seeds are high in fats and oils. (Casey-Arizona)
W70-09968

OBSERVATIONS ON THE STRUCTURE AND FUNCTION OF THE KIDNEY OF THE VAMPIRE BAT (DESMODUS ROTUNDUS MURINUS),
Arizona Univ., Tucson. Dept. of Anatomy.
Roy Horst.
In: Physiological Systems In Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 73-83, University of New Mexico Press, Albuquerque, New Mexico, 1969. 2 fig, 1 tab, 24 ref. National Foundation Grant G-24043.

Descriptors: *Physiological ecology, *Metabolism, *Water balance, Osmotic pressure, Ureas, Urine, Mammals.
Identifiers: *Bats, *Kidneys, *Henle's loops, *Urine concentrating mechanisms, Blood.

The diet of blood of the vampire bat is about 80 percent water and 20 percent protein. The high protein intake ensures a high urea production. In one meal the bat ingests a volume almost equal to its body weight. Aerodynamic considerations dictate a weight-lowering, and a copious, isotonic, low urea urine is excreted just after feeding onset. Since the bats do not drink free water, they must effect a highly concentrated urine when urea production begins. The kidneys of healthy bats were sectioned and microscopically examined for anatomical structures relevant to highly concentrated urea formation. The descending limb of Henle's Loop has specialized epithelial cells while the ascending limb is designed more simply--the opposite of what would be expected from current theories of kidney function. Vampire bats and kangaroo rats secrete urine of similar concentrations, but the bat has only one-third as many Henle's Loop cells, indicating much greater efficiency in individual cells. The vampire bat therefore confronts and solves water problems much like desert animals. (Casey-Arizona)
W70-09969

2J. Erosion and Sedimentation

TIN AND ZIRCONIUM IN THE SEDIMENTS AROUND THE BRITISH ISLES: A PRELIMINARY RECONNAISSANCE,
Carleton Univ., Ottawa (Ontario). Dept. of Geology; and Reading Univ. (England). Sedimentology Research Lab.
Patrick Arthur Hill, and Andrew Parker.
Economic Geology, Vol 65, No 4, p 409-416, June-July 1970. 8 p, 5 fig, 33 ref, append.

Descriptors: *Bottom sediments, *Beaches, *Sands, *Placer mining, Dunes, Mineralogy, Exploration, X-ray analysis, Surveys, Mapping.
Identifiers: *Zirconium, *Tin, *British Isles.

X-ray fluorescence analysis of 183 samples of beach and offshore sediment (mostly sand) from the Bristol Channel, Devon and Cornwall, the English Channel, the North Sea, and the coast of Ireland, shows that economic deposits of detrital tim are unlikely to be found anywhere but on the beaches of Cornwall or along offshore river valleys and strand lines. Economic deposits of zircon, together with other detritals, may be present in the North Sea at Spurn Head and the Dogger Bank. (Knapp-USGS)
W70-09531

VARIATION OF CATION EXCHANGE CAPACITY AND RATE WITH PARTICLE SIZE IN STREAM SEDIMENT,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W70-09535

CONTEMPORARY DEPOSITIONAL ENVIRONMENTS OF THE OMO DELTA,
Chicago University, Ill. Dept. of Geography.
Karl W. Butzer.
Nature, Vol 226, No 5244, p 425-430, May 2, 1970. 6 p, 1 fig, 15 ref.

Descriptors: *Sedimentation, *Deposition (Sediments), *Deltas, *Lakes, Geomorphology, Flood plains, Bottom sediments, Paleoclimatology, Channels, Geology, Sediments.
Identifiers: Africa, Ethiopia, Lake Rudolph, Omo Delta, Omo River.

Geomorphological and sedimentological studies of depositional environments of the modern Omo River Delta and floodplain were made for understanding of the Pliocene to Pleistocene formations of the lower Omo Basin (southwestern Ethiopia). The lower Omo Basin has a semi-arid tropical climate. Mean annual precipitation about 350 to 600 mm. Rainfall is lowest around shores of Lake Rudolf (at 370m) and increa rapidly in the highlands along the northern perip ries of the basin. The Omo River is the o perennial stream of the Lower Omo Basin an the entire Rudolf Basin. Active sedimentation optimal today in the lowland plains on floodpla deltas, mudflats and in littoral situations. standing waters of interdistributary basins bays, of the open prodeltaic environment, of lagoonal flats, or of the seasonally flooded pla can produce remarkably similar sediments. ferences and distinctions must be deduced fr bedding properties, oxidation, evaporites, verti and horizontal development, and geomorpholo cal settings. It is necessary to interpret sedimenta sequences with great care, with reference to stric defined concepts, and if possible with respect modern depositional counterparts. (Knapp-USG W70-09542

FIELD METHODS FOR MEASUREMENT FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
Harold P. Guy, and Vernon W. Norman.
For sale by Superintendent of Documents, U Government Printing Office, Wash, D.C. - 2040 Price $0.70. U S Geological Survey Techniques Water-Resources Investigations, Book 3, Chap C2, 1970. 59 p, 29 fig, 3 tab, 57 ref.

Descriptors: *Sediments, *Sediment transpo *Sampling, *Measurement, *On-site data colle tions, Surveys, Investigations, Instrumentati Sediment yield, Provenance, Particle size.
Identifiers: U S Geological Survey, Water resourc investigations.

Field methods for the measurement of fluvial se ment are described. It is desirable that the perso involved in sediment measurements be famili with the basic sediment concepts and the equi ment and techniques to be used for making time and efficient sediment measurements. The chara teristics and limitations of commonly used sample and some of the modifications of this equipment f special measurements are described. The chara teristics of measurement sites, the selection of san pling vertical and transit rates, the methods of ma ing sediment-discharge measurements, samplin quality control and timing, and some of the requir ments for sediment-related data are discussed. (K napp-USGS)
W70-09550

SEDIMENTATION, ANNOTATED BIBLIOG RAPHY OF FOREIGN LITERATURE, 196 1968 SURVEY NO 5.
Department of Agriculture, Washington, D.C.; an National Science Foundation, Washington, D.C.

Available from NTIS, Springfield, Va. as TT 6 55007, $3.00 in paper copy, $0.65 in microfich Jerusalem, Israel Program for Scientific Transl tions, Ltd, 1969. 395 p.

Descriptors: *Bibliographies, *Sedimentation *Foreign research, *Abstracts, Publications, Sedi ment transport, Deposition (Sediments), Erosion Sedimentology.
Identifiers: Sedimentation bibliography.

The fifth volume of the annotated bibliography o foreign literature on sedimentation contains 115 entries covering literature published outside th English-speaking world. The entries are arrange alphabetically by author, and a subject index is pro vided. This volume comprises material covering th years 1967-1968; an additional cumulative subjec index covers the preceding volumes. The literatur survey covered mainly periodicals, but also mono graphs, individual pamphlets and collected papers The sources used were available at scientific an technical libraries in Israel, and special subscrip tions were entered for a number of additiona periodicals. The source languages for this issu

were: Armenian, Azerbaijani, Belorussian, Bulgarian, Czech, Dutch, English, Flemish, French, Georgian, German, Greek, Hebrew, Hungarian, Italian, Japanese, Lithuanian, Mongolian, Norwegian, Polish, Portuguese, Rumanian, Russian, Serbo-Croat, Slovak, Spanish, Swedish, Turkish, and Ukrainian. (Knapp-USGS)
W70-09556

THE RELATIONS OF HYDROLOGY AND GEOMORPHOLOGY IN A HUMID TROPICAL STREAM BASIN - THE RIO GRANDE DE MANATI, PUERTO RICO,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
For primary bibliographic entry see Field 02E.
W70-09566

MAGNITUDE OF WAVES ON LAKE BUTTE DES MORTS AND THEIR EFFECT ON LAKE DEPTH AND SEDIMENT DISTRIBUTION,
Wisconsin State Univ., Oshkoch. Limnology Lab.
For primary bibliographic entry see Field 02H.
W70-09672

DEPOSITIONAL ENVIRONMENTS OF LAKE SUPERIOR SANDS THROUGH GRAIN SIZE ANALYSIS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Albert B. Dickas.
Available from the NTIS as PB-194 029, $3.00 in paper copy, $0.65 in microfiche. Center for Lake Superior Environmental Studies, Contribution No 15 (1970). 16 p, 1 tab, 5 fig. OWRR A-023-WISC (3).

Descriptors: *Particle size, *Sediments, *Lake Superior, Wisconsin, Rain, Littoral, Neritic, *Deposition (Sediments), Lake soils.
Identifiers: Pales-environments, Phi deviation.

As part of the problem of recognizing and reconstructing paleo-environments of arenaceous units in western Lake Superior, grain size parameters of modern fluvial, littoral and inner neritic lake sediments have been analyzed. Similar studies are reported from other geographic areas. While environmental field boundaries are of certain of these studies are curved and ill defined, other boundaries are differentiated on a linear basis, the system employed here due to the ease with which such a boundary is defined. Of all available graphs, that of phi deviation versus the diameter was found to be the most successful as it correctly classified 87.6 percent of all samples into a fluvial and a non-fluvial field. Further differentiation of non fluvial fields is displayed. While the method presented here is quite functional, correlation with other studies indicated that differing lines of separation between genetic fields must be determined on the local geographic level as predetermined by depositional energy factors. (See also W70-09674)
W70-09673

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Albert B. Dickas, and Paul C. Tychsen.
Reprint from Proceedings, 12th Conference Great Lakes Research, International Association of Great Lakes Research, p 161-169, 1969. 6 fig, 10 ref. OWRR A-023-WISC (6).

Descriptors: *Sediments, *Bed load, *Geology, *Particle size, Lake Superior, Wisconsin.
Identifiers: *Clastic material, Bois Brule River, Glacial cover.

A sedimentary analysis was made of the bed load (i.e. traction load) of the Bois Brule River, Douglas County, Wisconsin to better understand the statistical characteristics of the clastic material being transported by this stream and its contribution to the Holocene sedimentation history of the Wisconsin shoreline of Lake Superior. In addition, bedrock and glacial deposits were mapped throughout the drainage basin. The average mean size distribution of the clastic load, based on the phi scale, is as follows: 10% granules, 74% sand, 13% silt and 3% clay. To determine whether this dominantly sand-sized sediment was derived from basement rock or glacial debris, stream gravels larger than granule size were petrographically analyzed and compared to surficial and basement rock maps. Results indicate that the glacial cover is the prime source of the clastic material of the river load, concurring with the mapping program which shows that outwash sands and reworked glacial drift predominate over much of the drainage area. A secondary source is outcropping Keweenawan (Cambrian) sandstones. Earlier studies indicate the river load is deposited in Lake Superior out to a distance of 1/2 - 1 mile from the shoreline with the finer material found at the greater distance from the littoral zone. (See also W70-09767)
W70-09675

HYDRODYNAMIC MODEL OF THE BLAKE OUTER RIDGE,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 02L.
W70-09688

THE COLUMBIA RIVER AS A SOURCE OF MARINE LIGHT-SCATTERING PARTICLES,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Hasong Pak, George F. Beardsley, Jr., and P. Kilho Park.
Journal of Geophysical Research, Vol 75, No 24, p 4570-4578, August 20, 1970. 9 p, 8 fig, 17 ref. ONR Contract N00014-67-A-0369-0007.

Descriptors: *Suspended load, *Columbia River, *Turbidity, *Light penetration, Optical properties, Surveys, Suspension, Turbidity currents, Water quality, Continental slope.
Identifiers: *Light scattering.

The Columbia River plume region was investigated from June 20, to July 3, 1968 by light-scattering measurements and standard hydrographic station observations. The Columbia River plume was traced for 200 km by the light-scattering particles in the plume water. The scatterers are estimated to be contained in the plume water for at least 30 days. The observed distribution of particles indicates a northward deep current under the plume near the river mouth, a subsurface offshore flow near the bottom of the plume along the northern Oregon coast, and a major surface flow to the south and southwest. (Knapp-USGS)
W70-09690

EVALUATION OF GRAIN-SIZE PARAMETERS IN LACUSTRINE ENVIRONMENTS,
Computer Data Processors Ltd., Calgary (Alberta); and Calgary Univ. (Alberta). Dept. of Geology.
J. T. Solohub, and J. E. Klovan.
Journal of Sedimentary Petrology, Vol 40, No 1, p 81-101, March 1970. 21 p, 11 fig, 1 tab, 18 ref.

Descriptors: *Particle size, *Sedimentation, *Lakes, *Statistical methods, Regression analysis, Correlation analysis, Deposition (Sediments).
Identifiers: Factor analysis, Sedimentary environments, Depositional environments.

Using an area of recent lacustrine sedimentation as a reference model, several methods of treating grain-size distribution of sands were evaluated for their ability to discriminate between or identify, depositional environments. The techniques of Passega (1957), Mason and Folk (1958), Friedman (1961), Sahu (1964), and Klovan (1966) were applied to sediment samples from known depositional settings. Of the methods, only factor analysis (Klovan, 1966) produced mappable results consistent with known energy conditions at the depositional sites. The lack of success of the methods may result from any or all of the following factors: (1) Standard bivariate plots cannot adequately express the complex processes producing particular grain-size distributions. (2) Grain-size parameters are merely descriptors of grain-size distributions. As such they may not contain all available information, nor perhaps of the right kind, to enable environmental determination. (3) Combinations of amount and type of kinetic energy (which may be primarily responsible for the grain-size distribution of a sand) may produce similar distributions in different environments. The hypothesis that grain-size distributions can identify depositional environments is probably not universally valid. It is concluded that grain-size distributions reflect depositional processes rather than environment and that the two need not be the same. (Knapp-USGS)
W70-09693

AN EXACT METHOD FOR CHARACTERIZATION OF GRAIN SHAPE,
Michigan State Univ., East Lansing. Dept. of Geology; and Michigan State Univ., East Lansing. Dept. of Computer Science.
Robert Ehrlich, and Bernhard Weinberg.
Journal of Sedimentary Petrology, Vol 40, No 1, p 205-212, March 1970. 8 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Particle shape, *Statistical methods, *Fourier analysis, Sedimentation, Analytical techniques, Sedimentology.
Identifiers: Particle shape classification.

Grain shape may be described as precisely as needed by Fourier series expansion of the radius about the center of mass utilizing coordinates of peripheral points. Empirical results of grains from typical samples indicate that the series contains, in partitioned from, a large amount of geologically interesting information. Consequently, previous subjective evaluations of the worth of shape variations in the solution of geologic problems are justified. The shape variable is amendable to semiquantitative graphical evaluation or may be used as data for multivariate analytical schemes. Illustrative examples show that the shape variables easily discriminate grain differences arising from geographic, stratigraphic, and process factors. (Knapp-USGS)
W70-09697

BOTTOM SEDIMENTS OF LAKE MANAZALAH, EGYPT,
Alexandria Univ. (Egypt). Dept. of Oceanography; and Institute of Oceanography, Alexandria (Egypt).
For primary bibliographic entry see Field 02H.
W70-09699

THE KARST LANDSCAPE OF YUCATAN,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
William A. Finch, Jr.
Report available from NTIS as AD-679 464, $3.00 in paper copy, $0.65 in microfiche. Report 1968. 169 p, 41 fig, 16 tab, 70 ref, 3 append. ONR Contract N00014-67-A-0244-0001 NR 389-105 Subcontract No 79.

Descriptors: *Karst, *Geomorphology, Groundwater movement, Caves, Topography, Tropical regions, Humid areas, Wet climates, Limestones, Drainage effects, Drainage patterns (Geologic), Subsurface drainage.
Identifiers: Mexico, Yucatan.

A descriptive regional analysis was made of the physical aspects of Yicatan's karst landscape. Different types of karst land forms characterize individual types of horizontal limestone which underlies Yucatan. Distinctive microenvironments

characterize the individual types of karst land forms. Distinctive floristic communities are associated with these micorenvironments. The areal distribution of the different types of karst land forms yields a pattern which provides the regional framework used in this study. Three regions occur in Yucatan's karst landscape. Each region possesses a distinctive karst land form assemblage. These are (1) The Coastal Karst Region where fresh water springs flow from underground fissures creating less saline environments in the normally saline barrier beach, lagoon, and mangrove environments; (2) The Central Karst Region where cenotes, aguadas, and dolines are the common karst land forms; and (3) The Hill Karst Region where occur a multitude of caves. Appendices include a brief survey of karst literature, representative climatic data for Yucatan, and a selected glossary of Maya and Spanish landscape terminology. (Knapp-USGS)
W70-09707

ABOUT TURBULENT DIFFUSION OF SUSPENDED PARTICLES IN FLUID FLOW,
V. S. Sineltshikov.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D5, p 42-46, 1967. 5 p, 9 ref.

Descriptors: *Suspension, *Settling velocity, *Aeration, Hydrodynamics, Bubbles, Flow, Mixing, Air entrainment, Mathematical studies, Sediment transport.
Identifiers: Two phase flow.

Distribution of suspended particles with high magnitude of fall velocity is analyzed by hydrodynamical methods. The distribution of these particles is found to be similar to that of ideal gas molecules or Brownian particles in the field of gravity. The results obtained are used to describe air-bubbles distribution in aerated flow. (Knapp-USGS)
W70-09737

SOME STATISTICAL PROPERTIES OF DENDRITIC CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02E.
W70-09843

EFFECT OF PARTICLE SIZES TO TURBULENT DIFFUSIVE PROCESSES IN FREE SURFACE FLOW,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09861

MEASUREMENTS OF THE INFLUENCE OF SUSPENDED PARTICLES ON THE SIZE OF VORTICES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erdbau.
For primary bibliographic entry see Field 08B.
W70-09862

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
G. Courtois.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/9, p 117-165, 1967. 49 p, append, 262 ref.

Descriptors: *Tracers, *Tracking techniques, *Radioisotopes, *Sediment transport, *Reviews, Bibliographies, Sediment load, Sedimentology, Radioactivity techniques, Bed load, Suspended load, Sampling.
Identifiers: Sediment tracing.

Radioisotopes have two main uses in sedimentology: they are used for the study of sediment movements in rivers and seas, and for continuous measurements of the amount of sediment suspended in a given medium. The technical aspects of using artifical tracers include the choice of radioisotope, surface and mass labelling (with particular reference to the problem of silting), immersion and detection equipment, and problems of navigation and topographical reference points. The problem of obtaining quantitative results is discussed and the proposed methods are described. The methods described may also be applied to related problems of considerable importance (soil erosion, soil stabilization and the movement of sand dunes) and brief references are made to these problems. Since the transport of suspended solids is generally much more significant than bed-load movement, continuous measurements are of great importance. A number of examples are given of the value of information obtained by such measurements. Other radioisotope techniques which may also be used in sedimentology are dating, analytical studies (either continuous analysis of core samples by means of X-ray flourescence or the detection of trace elements by activation analysis), use of tracers, for example for the study of particle movements when affected by freezing of the soil or for the study of the formation and precipitation of sediment as a function of the physico-chemical characteristics of the waterbody, and measurements of sediment density by means of back-scattering gages. A bibliography of 262 references is included. (See also W70-09868) (Knapp-USGS)
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
D. B. Smith, and T. V. Parsons.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/11, p 167-180, 1967. 14 p, 7 fig, 5 ref.

Descriptors: *Sediment transport, *Silts, *Tracers, *Tracking techniques, *Dredging, Waste disposal, Path of pollutants, Radioisotopes, Radioactivity techniques, Topography, Bed load, Suspended load, Estuaries, Currents (Water).
Identifiers: Dredging spoil.

The techniques used in a series of investigations into silt movement from spoil grounds in the Forth estuary are described. The tracers used were Sc-46 and La-140, incorporated in ground glass which was distributed in spoil in a hopper and deposited to stimulate normal dredging practice. Qualitative tracer movement was measured in the estuary and quantitative values were obtained in a dockyard by measurement of the vertical distribution of the tracer. The extensive upstream movement of spoil from the normal area of deposition showed that it was an economically unsatisfactory spoil ground. An alternative area was selected by study of the topography of the estuary bed and the prediction of downstream silt movement from this area was confirmed by tracer studies. (See also W70-09868) (Knapp-USGS)
W70-09876

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 02L.
W70-09877

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 07B.
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
B. L. Campbell, and B. W. Seatonberry.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No Sm-83/15, p 227-232, 1967. 6 p, 2 fig, 10 ref.

Descriptors: *Tracers, *Tagging, *Sands, *Tracking techniques, *Radioisotopes, Radioactivity techniques, Chromium, Chemical precipitation, Erosion, Sediment transport, Beaches, Littoral drift, Bed load.
Identifiers: Chromium radioisotopes.

A new and efficient method for labelling sand with multicurie amounts of Cr-51 is described. It is based on the formation of chromic oxide when ammonium dichromate is thermally decomposed. The technique has been used successfully with silica sand from Botany Bay, N. S.W. The ammonium dichromate is intimately mixed with the sand and then decomposed by raising the temperature while keeping the mass stirred. About 70% of the chromic oxide adheres to the sand. The radioactive label is stable over long periods of immersion in sea water and is resistant to the type of abrasion which can occur in sand-tracing experiments. The application of this method to the production of 25-kg batches of labelled sand is described. It is possible that the method could be applied to other granular solids which are stable up to 400 deg C. (See also W70-09868) (Knapp-USGS)
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
H. Bougault, A. Caillot, G. Courtois, and B. Jeanneau.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/16, p 233-262, 1967. 30 p, 11 fig, 3 tab, 6 ref.

Descriptors: *Tagging, *Sands, *Silts, *Tracers, Sediment transport, Gold radioisotopes, Chromium, Radioisotopes, Radioactivity techniques, Chemical precipitation, Bed load, Suspended load, Tracking techniques.
Identifiers: Chromium radioisotopes.

There are two major methods of using radioisotopes to study sedimentary movements. In mass-labelling, the sediment is replaced by a glass containing an element that can be activated, and in surface labelling, a physico-chemical treatment makes it possible to deposit a radioisotope on the surface of the sediment. Surface labelling is used mainly for sands, when a large number of labelled particles is necessary (for statistical purposes); and for silts, when it is necessary to retain the features associated with their dynamic properties. Simple and rapid methods of labelling were developed to be applied at the site of the experiment by persons possessing only limited equipment for handling radioisotopes. The process recommended for labelling sands by using Au-198 is a combination of the Petersen method (treatment with tin chloride) and that of Campbell (treatment with silver) after pre-treatment with nitric acid and soda. By this method, it is possible to deposit 125 mg of gold per kilogram of sediment with an efficiency of 95%.

For marking sands with Cr-51 a film of silica gel is first deposited and radioactive lead chromate is then adsorbed on to it. In this way, 500 mg of chromium per kilogram of sand can be fixed with more than 90% efficiency. The labelling of silts by using Au-198 is achieved with a neutralized chlorauric acid solution. The gold is reduced on contact with the silt on which it is fixed. Ten Ci/kg of sediment can be fixed with 100% efficiency. (See also W70-09868) (Knapp-USGS)
W70-09881

INVESTIGATION INTO THE MOVEMENT OF FLUVIAL BED-LOAD WITH RADIOISOTOPES,
Research Inst. for Water Resources Development, Budapest (Hungary).
Zs. Erdelyszky, and K. Stelczer.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/18, p 263-269, 1967. 7 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Sediment transport, *Abrasion, *Tracers, *Tracking techniques, Radioactivity techniques, Radioisotopes, Sands, Bed load, Particle size.
Identifiers: Bed load tracers.

A new method was devised for determining the abrasion of sediment grains under natural conditions. Similarly marked gravels of different spectrum energy corresponding to different diameters were put into the water at a certain point in the Danube after which they were followed with a special nuclear device prepared for this purpose, so that the grains of the sediment could be separated according to their diameters. (See also W70-09868) (Knapp-USGS)
W70-09882

A CONTRIBUTION TO THE KINETIC THEORY OF BED-MATERIAL DISCHARGE,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
P. Todorovic, V. Vukmirovic, R. Vukotic, and A. Filip.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/19, p 271-290, 1967. 20 p, 8 fig, 1 tab, 6 ref.

Descriptors: *Sediment transport, *Bed load, *Tracers, *Tracking techniques, Radioactivity techniques, Radioisotopes, Stochastic processes, Statistical methods, Mathematical studies.
Identifiers: *Yugoslavia, Danube River.

Investigations of fundamental kinetic characteristics of bed-material discharge can be carried out by means of radioactive tracers. Tracer experiments were accomplished on the Danube and Velika Morava Rivers, and were supported by the International Atomic Energy Agency. A theoretical base is given for the study of the kinetic characteristics of bed-material discharge. Practical applications of the results are discussed. Theoretically, the problem of bed-material discharge was considered as a stochastic process. (See also W70-09868) (Knapp-USGS)
W70-09883

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
J. de Ploey.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy andGeophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/14, p 291-301, 1967. 11p, 7 fig, 8 ref.

Descriptors: *Soil erosion, *Sands, *Impact (Rainfall), *Tracers, *Radioactivity techniques, Tracking techniques, Radioisotopes, Rainfall-runoff relationships, Grasslands.
Identifiers: Congo.

Vast expanses of the western part of central and southern Africa are covered with uniform, sandy formations of the Kalahari type. The topography of these areas and their present morphological characteristics are mainly the result of erosion by rain. Information on the hydrology of the surface waters in these areas is fairly limited and is insufficient to permit any conclusion regarding the way in which erosion by rain takes place. To obtain a better understanding of these phenomena, Sc-46 labelled radioactive sand was used to trace rain erosion. Series of labelled samples were placed successively on the surface of the experimental plot and the erosive effect of rain was determined by measuring the residual concentrations after rainfall. Some samples were placed below a shield so as to eliminate the effects of splash and reveal the part played by runoff. Radiographic films were used to study the dispersion of labelled particles in the surrounding area. This radiographic method made it possible to determine the scale of erosion by splash for different rainfall conditions. Erosion by rain on Kalahari ground covered with sub-steppe savannah is caused mainly by splash erosion and by dispersed, intermittent runoff. Sheet-wash plays no part if the slope is less than 12 deg. (See also W70-09868) (Knapp-USGS)
W70-09884

LOESS--THE YELLOW EARTH,
Leeds Univ. (England); and BISRA-The Inter-Group Labs. of British Steel Corp., London (England).
I. J. Smalley, and R. L. S. Taylor.
Science Journal, Vol 6, No 2, p 28-34, Feb 1970. 7 p, 9 fig.

Descriptors: *Loess, *Deposition (Sediments), Soil types, Soils, *Soil formation, Soil structure, Soil stability, Soil erosion, *Aeolian soils, Finegrained soils, Geographical regions, Soil properties, Agriculture.
Identifiers: Soil maps, *Soil deposits.

Loess, an extremely fine earth formed by aeolian deposition, covers vast tracts of the world's land surface, sometimes to the depth of 100 m. Loess is an excellent agricultural soil and has had considerable influence on the development of civilization. Several theories of deposition and formation of loess particles are discussed. Glaciers are suggested as the main producers of loess material. When a glacier melts, a load of detritus containing 2 distinct sizes of quartz particles is deposited. Separation of fine particles and deposition as homogeneous deposits some distance away provide the sediments called loess. The fine particles are lifted by the wind, the nature of the transported material being controlled by a lift factor and a carry factor. Very small particles cohere tightly and large particles are too heavy to move. The wind lifts most efficiently particles having diameters of about 0.08 mm (the lift factor). The critical particle size above which particles are not carried by the wind in suspension is about 0.2 mm (the carry factor). In this way, the lift factor imposes limits on the eventual loess deposit, and the carry factor reinforces the limits. Once deposited, the relatively high cohesive forces keep the loess stable and erosion occurs only if the material is disturbed. (USBR)
W70-09909

TESTS OF THEORETICAL CALCULATIONS OF DISCHARGES OF SUSPENDED SEDIMENT IN PLAINS RIVERS,
K. V. Razumikhina.
Tr Gos Gidrol Inst No 156, p 31-38, 1968. Bur Reclam Transl 828, Jan 1970. 18 p, 4 fig, 4 tab, 8 ref.

Descriptors: *Fluvial hydraulics, Foreign research, Mathematical analysis, *Suspended sediments, River flow, Sediment transport, Chezy equation, *Sediment discharge, Streamflow records, *Turbidity, *Rivers, Roughness (Hydraulic), Grain sizes, Reservoirs, *Bottom sediments, Flood plains, Hydrographs, Discharge (Water), Streambeds, *Sedimentation.
Identifiers: USSR, High flow, Flood stages.

Formulas are presented for computing the discharge of suspended sediment in plains rivers. The formulas relate the turbidity of the flow to the sediment discharge through computation of scour turbidity (related to streamflow characteristics) and a hydromechanical sediment parameter (related to sediment composition and streamflow characteristics). Granular roughness of the streambed is determined by analysis of particle size. Computed and measured values of the sediment discharge are compared for various phases of the flow regime, including low flows and spring floods. The relationship between measured river discharge and suspended discharge depends on river characteristics; the rivers studied are classed into 3 groups. Recommendations for application of the formulas and the limits of applicability are discussed. (USBR)
W70-09910

2K. Chemical Processes

THE APPLICATION OF LASER IONIZATION MASS SPECTROMETRY TO THE IDENTIFICATION OF ORGANIC SALTS IN POLLUTED WATER,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 05A.
W70-09522

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION,
Pennsylvania State Univ., University Park. Dept. of Materials Science.
For primary bibliographic entry see Field 05A.
W70-09523

TIN AND ZIRCONIUM IN THE SEDIMENTS AROUND THE BRITISH ISLES: A PRELIMINARY RECONNAISSANCE,
Carleton Univ., Ottawa (Ontario). Dept. of Geology; and Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02J.
W70-09531

VARIATION OF CATION EXCHANGE CAPACITY AND RATE WITH PARTICLE SIZE IN STREAM SEDIMENT,
Geological Survey, Denver, Colo.
Ronald L. Malcolm, and V. C. Kennedy.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R153-R160, May 1970. 8 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Ion exchange, *Sediments, *Particle size, Bed load, Suspended load, Cation exchange, Gravels, Silts, Sands, Clays, Clay minerals, Sediment transport, Sedimentation, Water chemistry, Water quality, California.
Identifiers: Mattole River (Calif.).

A potassium specific-ion electrode was used to determine the rate of Ba-K/exchange and the cation exchange capacity (CEC) of the size-fractionated stream sediment from the Mattole River of northern California. The time required for 75 percent completion of exchange ranged from 3 sec for clay fractions to 12 hr for gravels. The average CEC of the clay, silt, sand, and gravel fractions were 37.6, 11.0, 9.7, and 7.2 meq/100 g, respectively. Organic matter contributed about 15 percent of the total cation-exchange capacity of the

sediment. The CEC of the sand and gravel fractions exclusive or organic matter were 5.5 to 8.0 meq/100 g; they must be included in a consideration of the total exchange, chemical properties, and transport phenomena of the stream. (Knapp-USGS)
W70-09535

CARBON AND OXYGEN ISOTOPE FRACTIONATION IN THE SKELETAL CARBONATE OF REEF-BUILDING CORALS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
Jon N. Weber, and Peter M. J. Woodhead.
Chemical Geology, Vol 6, No 2, p 93-117, July 1970. 25 p, 3 fig, 5 tab, 81 ref. NSF Grant GA-1437.

Descriptors: *Stable isotopes, *Water chemistry, *Coral, *Calcium carbonate, Sediments, Provenance, Chemical precipitation, Carbon, Oxygen, Tracers, Tracking techniques, Mathematical models, Reefs, Carbonates, Limestones.
Identifiers: Isotope fractionation, Australia, Great Barrier Reef.

Study of geochemistry of carbonate sediments and carbonate rocks is aided by a detailed understanding of the isotopic composition of the various sediment contributors. The coelenterates are of particular interest in this respect because the stable isotope ratios of their skeletons are controlled by both vital and inorganic environmental factors. To determine the relative importance of these factors, 475 specimens in 50 genera were selected from the coral population of Heron Island on the Great Barrier Reef of Australia. The samples were taken from tow depth environments: (1) surface, defined as 0-4.6 m; and (2) 18 m. The observed range of C-13 variation is 1.3% with respect to PDB standard carbon dioxide; that of 0-18 is 0.4%. A MODEL INCORPORATING BOTH BIOLOGICAL AND ENVIRONMENTAL FACTORS WAS DEVELOPED TO ACCOUNT FOR ISOTOPE RATIO VARIATIONS IN COELENTERATE CARBONATE. The analytical data are consistent with the model. At a specific reef locality, the most important factors causing isotope ratio variations in the skeletal carbonate of corals are zooxanthellar activity and temperature. (Knapp-USGS)
W70-09545

THE OCCURRENCE OF THALLIUM IN SEA WATER AND MARINE SEDIMENTS,
Liverpool Univ. (England). Dept. of Oceanography.
A. D. Matthews, and J. P. Riley.
Chemical Geology, Vol 6, No 2, p 149-152, July 1970. 4 p, 2 tab, 6 ref.

Descriptors: *Trace elements, *Sea water, *Sediments, *Thallium radioisotopes, Neutron activation analysis, Sampling, Chemical analysis, Geochemistry, Water chemistry, Minerology, Clay minerals, Ion exchange, Adsorption.
Identifiers: Thallium.

The concentration of thallium in the water column at a station in the North Atlantic has been investigated using a neutron activation procedure. Values ranging from 9.4 - 16.6 ng/liter were found. Thallium has been determined in 11 deep sea sediments. Experiments suggest that the geochemical balance of the element in the oceans may be maintained by adsorption on the hydrous manganese dioxide phase of ferro-manganese minerals and by incorporation into the lattice of illite and similar clay minerals. (Knapp-USGS)
W70-09546

THE MOVEMENTS OF DIFFERENT SALT SOLUTIONS IN SOIL PROFILES,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Jutato Intezete, Budapest.
For primary bibliographic entry see Field 02G.
W70-09577

ON THE PROBLEM OF SALT DIFFUSION IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09578

VERTICAL DISTRIBUTION OF EXCHANGEABLE CATIONS IN SOILS OF ARID ZONES AS AN INDICATION TO THE DEPTH OF WATER INFILTRATION,
Egyptian Desert Inst., Cairo.
For primary bibliographic entry see Field 02G.
W70-09581

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 05A.
W70-09674

WATER-CLAY INTERACTIONS IN NORTH CAROLINA'S PAMLICO ESTUARY,
North Carolina Univ., Chapel Hill. Dept. of Geology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 02L.
W70-09678

THE CHEMISTRY OF THE INTERSTITIAL WATER AS A MEASURE OF CONDITIONS IN A SANDY BEACH,
National Inst. for Water Research, Congella (South Africa).
For primary bibliographic entry see Field 05A.
W70-09679

APPLICATIONS OF FLUORESCENCE SPECTROSCOPY TO FUNDAMENTAL PROBLEMS IN INSECT BIOCHEMISTRY,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05A.
W70-09682

DISPERSION OF NATURALLY OCCURRING IONS IN GROUNDWATER FROM VARIOUS ROCK TYPES IN A PORTION OF THE SAN PEDRO RIVER BASIN, ARIZONA,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. E. Wallace, and L. R. Cooper.
Journal of Hydrology, Vol 10, No 4, p 391-405, June 1970. 15 p, 9 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Water chemistry, *Dispersion, *Tracers, *Arizona, Solutes, Alluvium, Recharge, Discharge (Water), Flow nets, Leaching, Mixing, Ion transport, Ions.
Identifiers: San Pedro River basin (Ariz).

The groundwater in an alluvial basin in southern Arizona was analyzed for concentrations of Ca, Mg, Na, and Cl ions. The variety of rock types in the area, plus the undisturbed state of the groundwater basin, make comparative rock mineralization-groundwater ionization interpretations possible. Ionic dispersion in groundwater emanating from source areas composed of differing rock types is plotted as isogram maps. These isolated areas of differing mineral composition each exhibit a unique ionic contribution to groundwater. The ion concentrations in groundwater were then used as naturally occurring tracers to determine source areas of recharge and to delineate subsurface barriers to the normal basin flow net. Ion dispersion plots reveal the carbonates of the Dragoon Mountains to be a major contributor of Ca and Mg to the deep alluvial portion of the basin. Cl dispersion patterns show the granitic intrusives of the Tombstone Hills produce a barrier effect in the normal flow pattern of the basin as well as being a contributor of Cl to groundwater. (Knapp-USGS)
W70-09692

ANALYSIS OF MULTICOMPONENT ORGANIC MIXTURES IN AQUEOUS MEDIA BY PYROLYSIS,
Rocketdyne, Canoga Park, Calif. Research Div.
For primary bibliographic entry see Field 05A.
W70-09694

CHROMIUM SPECIATION IN SEA WATER,
Leeds Univ. (England).
H. Elderfield.
Earth and Planetary Science Letters, Vol 9, No 1, p 10-16, August 1970. 7 p, 4 tab, 22 ref.

Descriptors: *Chromium, *Sea water, Water chemistry, Trace elements, Chemical reactions, Oxidation-reduction potential, Chemical precipitation, Sedimentation.
Identifiers: Chromium ions (Sea water).

Comparison of an equilibrium model for Cr in sea water (and in marine sediments) with the real system has revealed a significant discrepancy in that the predicted Cr (III) concentration in sea water is considerably less than that actually found. While chemical thermodynamics can qualitatively describe possible Cr species in sea water, other parameters are also involved in controlling the Cr oxidation ratio. The slow oxidation rate of Cr (III) is suggested as being a likely causal factor. The reduction of Cr (VI) by organisms and/or organic matter should also be nonlabile but an organic factor cannot be completely ruled out since the mechanism of concentration of Cr by marine animals is unknown. (Knapp-USGS)
W70-09696

STUDY ON SALT WATER INTRUSION INTO GROUND WATER - PART 2. GEOCHEMICAL RESEARCH OF SALT GROUNDWATER (JAPANESE).
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Kiyoji Ikeda.
Bulletin of Geological Survey of Japan, Vol 18, No 6, p 15 (393)-33 (411), June 1967. 19 p, 17 fig, 13 tab, 8 ref.

Descriptors: *Geochemistry, *Saline water intrusion, Groundwater, Aquifers, Ion exchange, Clay minerals, Leaching, Groundwater movement, Water chemistry, Path of Pollutants.
Identifiers: Japan, Fuji.

The Cl contents of coastal groundwater in Fuji city, Shizuoka prefecture, Japan have increased rapidly since 1960. The salt groundwater is mainly in the Fuji lava, and the salt-water zone has been widened rapidly. The chemical components of the salt groundwater are generally characterized as noncarbonate hardness type, and differ from those of sea water at the early stage of salting. Groundwater has: (1) higher Ca content; (2) slightly higher SO4 content; and (3) lower Na, K and HCO3 contents than the chemical components of sea water and groundwater proportionally mixed. Experimental results suggest that the change of chemical compositions at the early stage of salting is due to base-exchange and dissolution reaction between sea water and clay in the water-bearing layers. (See also W70-09732). (Knapp-USGS)
W70-09733

AN NMR STUDY OF THE PROTOLYSIS KINETICS OF SULFONAMIDES,
Georgia Univ., Athens. Dept. of Chemistry; and Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05A.
W70-09770

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID IN-

DUSTRIAL WASTES, FORMATION WATERS, AND MINERALS IN SALAQUIFERS OF ALABAMA; PART II, LABORATORY STUDY OF SELECTED RESERVOIR ROCKS,
Alabama Univ., University. Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09773

MODIFICATION OF THE ISOTOPIC COMPOSITION OF RAINWATER BY PROCESSES WHICH OCCUR BEFORE GROUNDWATER RECHARGE,
Weizmann Inst. of Science, Rehovoth, (Israel).
J. R. Gat, and Y. Tzur.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/4, p 49-60, 1967. 12 p, 3 fig, 22 ref.

Descriptors: *Tracers, *Tracking techniques, *Radioisotopes, *Stable isotopes, *Hydrologic cycle, Deuterium, Tritium, Oxygen, Surface waters, Groundwater movement, Precipitation (Atmospheric), Evaporation, Evapotranspiration.
Identifiers: Isotopic fractionation (Water).

The isotopic composition of groundwaters differs from that of the average rain composition due to selection (seasonal or otherwise) from among different rainfalls during the replenishment of groundwaters, as well as to isotope fractionation in some of the steps in the recharge process. An assessment of the resulting concentration changes is required before the characteristic variations of the isotopic composition of atmospheric waters can be used as hydrological tracers of groundwaters. An over-all measure of the fractionation effect is obtained by comparison of the isotopic composition of rain and groundwaters in regions in Israel of known hydrological pattern and recharge areas. Correlation of the effects with the areal environmental factors gives preliminary clues to the causes of fractionation. Of these the formation of puddles after rain seems particularly effective. Water-transport processes, which are steps in the rain-to-groundwater transition, are evaluated regarding their potential contribution to the modification of the isotopic composition. They include interception by vegetation, open-water evaporation and exchange with ambient vapor from overland flow and surface runoff, evaporation of soil moisture, transpiration, and water transport by unsaturated flow in the zone of aeration. (See also W70-09868) (Knapp-USGS)
W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02A.
W70-09872

PHOTOSYNTHESIS AND ZONATION OF FRESHWATER MACROPHYTES,
Saint Andrews Univ. (Scotland). Dept. of Botany.
D. H. N. Spence, and Jean Chrystal.
New Phytologist, Vol 69, No 1, p 217-227, 1970. 2 fig, 30 ref.

Descriptors: *Photosynthesis, *Fresh water, Sun, Depth, Oxygen, Productivity, Light intensity, Chlorophyll, Energy, Carbon dioxide, Respiration, Mathematical models.
Identifiers: *Macrophytes, Shade, Potamogeton polygonifolius, Potamogeton obtusifolius, Leaf area, Leaf thickness.

The photosynthetic response of leaves produced in a glasshouse under both sun and shade conditions, from two species rooted in different depths of water is compared. There are significant, inherent differences in morphological and photosynthetic responses to light of 'sun' species of Potamogeton obtusifolius leaves (mean water depth 130 centimeters) and Potamogeton polygonifolius 'shade' species (mean depth 9 centimeters). Potamogeton obtusifolius has a rather similar photochemical capacity to P polygonifolius but has a lower energy yield value. It is concluded that a higher net photosynthetic capacity of this shade species in low irradiance such as 1% daylight must be achieved by reduction in respiration rate per unit area and leaf thickness, and increases in specific leaf area. Perhaps lowered respiration rate is partially a consequence of reduction in leaf weight/unit area and in ratio of non-assimilatory to assimilatory tissue; these factors may balance reduced light absorption by the thinner leaf. It is suggested that the limitation of net photosynthesis in shade species at levels of irradiance in which sun species are not limited, is related in a species like Potamogeton obtusifolius to its inability to reduce specific leaf area, thicken leaves and thus increase its capacity to absorb light. (Jones-Wisconsin)
W70-09888

PHOSPHORUS REQUIREMENTS OF TWO PLANKTONIC DIATOMS IN STEADY STATE CULTURE,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Edward J. Carpenter.
Journal of Phycology, Vol 6, p 28-30, 1970. 1 fig, 1 tab, 12 ref.

Descriptors: *Phosphorus, *Nutrient requirements, *Plankton, *Diatoms, *Cultures, Temperature, Light intensity, Hydrogen ion concentration, Carbon dioxide, Laboratory tests.
Identifiers: *Steady state, Cylindrotheca closterium, Nitzschia, Cyclotella nana, Chemostat.

Investigations on algal phosphorus requirements were carried out in batch culture systems in which conditions existing in nature are not approached due to unnatural increases in algal metabolites, changes in pH and carbon dioxide concentration, and lack of fresh nutrient input. The chemostat, a continuous-flow open system, can eliminate or reduce some of these limitations because new medium is continually introduced to the culture vessel and a suspension of algae and new and old media continually exists. Application of the chemostat is described in determining the limiting phosphorus requirements, at one growth rate, of two planktonic marine diatoms. Minimum phosphorus requirements of Cylindrotheca (Nitzschia) closterium and Cyclotella nana, were measured in axenic steady state chemostat culture. C closterium and C nana required 1.055 and 1.045 temto gramatoms phosphorus/cell per generation of 0.20 divisions/day. Algae were cultured at 15.5C and exposed to 5380 lux on a light-dark cycle of 19 and 5 hours. Phosphorus requirement/unit of cell volume was 0.0135 and 0.0129 temto gram-atoms phosphorus per cubic micron of cell volume for C closterium and C nana, respectively. (Jones-Wisconsin)
W70-09896

TRANSFORMATION OF RIVER WATER AT THE MOUTH OF A RIVER AND SOME CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
A. Simonov.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 4 p.

Descriptors: *Water pollution, *Rivers, Sewage disposal, Sewage treatment, Mathematical model, Salinity, Flows, Currents (Water).
Identifiers: *Criteria, *Marine discharge.

Results are given for theoretical and experimental hydrological-hydrochemical investigations of the transformation of river water into sea water at the mouth of several rivers of the U.S.S.R. The studies are concerned with the main features of exchange mechanism of physical and chemical characteristics at the dividing zone of the river and sea water at the mouth where there are no marked tidal phenomena. The current velocity any distance from the river, at the mouth, depends on the velocity of the river mouth, on the depth and on a parameter taking into account the actual physical and chemical exchange conditions. Decreasing current velocity of the flow is characterized by the satisfaction of a negative exponent. The equation of the water discharge for flow currents over the increasing depths obeys the exponential law and depends on the water discharge in the river mouth, on the depth and on the exchange conditions in the dividing area. The equations of water discharge and velocity of flow current are the main equations for estimating the distribution of other hydrological and hydrochemical characteristics of the mouth. The flow current water salinity with little wind increases sharply at the beginning of mixing then its rate of increase gradually decreases at some distance from the lower cross section of the river. Equations are derived for estimating a mean concentration of the main salt components and artificial admixtures. (Hancuff-Texas)
W70-09946

2L. Estuaries

THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05A.
W70-09564

THE MATHEMATICAL MODELING OF A STRATIFIED ESTUARY,
Imperial Chemical Industries Ltd., Billingham (England). Heavy Organic Chemical Div.
G. D. Hobbs.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 6 p, 15 ref.

Descriptors: *Density stratification, *Mathematical models, *Estuaries, *Water quality, Saline-water-Freshwater interfaces, Mass transfer, Mixing, Tidal effects, Rivers, Hydrodynamic, Water chemistry, Diffusion.
Identifiers: Radioactive tracers.

The application was investigated of one- and two-dimensional mathematical models to the prediction of water quality in the estuary of the River Tees, a partially-mixed estuary suffering pollution from industrial waste water and domestic sewage. The one-dimensional model implied that all quantities of interest can be regarded as varying only with position along the river. This type of description is of most value for shallow freshwater streams and estuaries of the well-mixed type. The two dimensions under consideration were length and depth. A two-dimensional description will be of most value for partially stratified estuaries in which quantities varying significantly but smoothly over the depth. The relation of this work to the development of a complete model, incorporating both the hydrodynamics and the biochemistry, and verified against field data is briefly discussed. (Hsieh-Vanderbilt)
W70-09607

COOLING WATER OUTLET IN A STRATIFIED RECIPIENT,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).
For primary bibliographic entry see Field 05C.
W70-09609

WATER-CLAY INTERACTIONS IN NORTH CAROLINA'S PAMLICO ESTUARY,
North Carolina Univ., Chapel Hill. Dept. of Geology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
David A. Dobbins, Paul C. Ragland, and J. Donald Johnson.

Environmental Science and Technology, Vol 4, No 9, p 743-748, September 1970. 6 p, 6 fig, 5 tab, 22 ref.

Descriptors: *Estuaries, *Water chemistry, *Clay minerals, *North Carolina, Ion exchange, Cation adsorption, Saline water systems, Mixing, Saline water-freshwater interfaces, Connate water, Bottom sediments.
Identifiers: Pamlico Estuary (N C).

A natural estuarine environment was examined to show the chemical relationship between various waters and sediments. The pore to bottom water ratio of cationic equivalents measured at 20 stations increases systematically downstream from about 0.6 to 1.2 along the 50-mile profile in North Carolina's Pamlico River estuary. This trend is apparently controlled by entrapment of relatively saline water after northeasterly storms as the suspended load settles. Cationic concentrations generally decrease in the pore waters with depth, from a maximum 10-20 cm beneath the sediment-water interface. An increase of K equivalent ionic fraction in the pore waters with depth may be related to H ion exchange with the sediments. A strong correlation between exchangeable Mg and chlorite, as well as exchangeable K and illite, was noted. The ionic data are related to changes in the natural system and not to contamination by municipal wastes. (Knapp-USGS)
W70-09678

HYDRODYNAMIC MODEL OF THE BLAKE OUTER RIDGE,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
George M. Bryan.
Journal of Geophysical Research, Vol 75, No 24, p 4530-4537, August 20, 1970. 8 p, 9 fig, 16 ref. Naval Ships Systems Command Contracts NO bsr 85077 and N00024-67-C-1186.

Descriptors: *Sedimentation, *Continental shelf, *Florida, *Continental slope, *Marine geology, Oceans, Atlantic Ocean, Ocean currents, Currents (Water), Computer models, Model studies, Mathematical models, Topography, Deposition (Sediments), Hydrodynamics.
Identifiers: Blake Plateau, Blake Outer Ridge.

Formation of the Blake outer ridge by differential deposition of sediment on a relatively flat-lying floor (horizon A) is discussed on the basis of the hydrodynamic interaction of two oppositely directed currents, which are decelerated in the interaction zone and diverted to a final direction taken to be the trend of the Blake outer ridge. If one or both of the currents carry sediment, deposition occurs preferentially in the region of decelerated flow, so that sediment distribution is governed by the steady-state velocity field. Streamlines and isotachs computed from a model of two-dimensional streamline flow are found to be consistent with the known sediment distribution; they require upstream current widths in substantial agreement with estimated widths of the Florida Current and the Western Boundary Undercurrent. The Florida Current contributes relatively coarse sediment; the undercurrent, very fine sediment. (Knapp-USGS)
W70-09688

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W70-09732

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09739

ESTUARINE CONSERVATION LEGISLATION IN THE UNITED STATES,
For primary bibliographic entry see Field 06G.
W70-09786

SIGNIFICANCE OF DDT RESIDUES FROM THE ESTUARY NEAR PENSACOLA, FLA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla., Center for Estuarine and Menhaden Research, Breeze, Fla.
For primary bibliographic entry see Field 05B.
W70-09847

CALCULATION OF COASTAL ENERGY AND DRIFT RATE,
Florida State Univ., Tallahassee. Dept. of Geology.
William F. Tanner.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S34, p 313-317, 1967. 5 p, 3 ref.

Descriptors: *Beaches, *Waves (Water), *Beach erosion, *Littoral drift, Ocean currents, Mathematical studies, Sediment transport, Shore protection.
Identifiers: *Spits.

An exponential equation is developed, relating shelf slope to wave energy. Wave energy is taken as the dependent variable. The coefficient on the exponent, and the initial conditions, are obtained from published data. The fit, for certain coasts in the southeastern United States (where convergence-divergence problems are not serious) is good. Depletion-accumulation rates are converted, on the basis of a study of a spit of apparently known dimensions and age, into work figures; this study is then compared with field data from two other, similar, spits. The distance term necessary to make the conversion appears to be about 5 kilometers, for an inferred history of 4,000 years. An impulse determination yields about the same results. For the areas studied, available wave energy is about 1 million times the energy spent in unidirectional littoral sediment transport. (Knapp-USGS)
W70-09853

APPLICATION OF NUMERICAL CALCULATIONS TO THE STUDY OF WAVES AND SHORE INTERACTIONS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
Jean-Pierre Lepetit.
Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S32, p 300-306, 1967. 7 p, 6 fig, 3 ref.

Descriptors: *Beaches, *Waves (Water), *Data processing, *Computer programs, Erosion, Engineering, Beach erosion, Statistics, Data collections, Shore protection.
Identifiers: France, Wave energy.

An accurate knowledge of local wave conditions is prerequisite to successful coastal engineering design. This article is a brief description of the various computer calculations employed by the Laboratoire National d'Hydraulique, France, to process wave recorder data. The first of these programs provides a statistical analysis of the raw data. The second program analyzes the variation of the characteristic values as functions of time and predicts the characteristics of the centenary and millenary waves. The third calculation permits a study of inshore conditions by means of wave refraction diagrams. (Knapp-USGS)
W70-09854

AN ANALYSIS OF SALINITY DISTRIBUTION IN THE STRAITS OF MARACAIBO,
Massachusetts Inst. of Tech., Cambridge, Hydrodynamics Lab.; National Inst. of Canalizations, Caracas (Venezuela); and State Univ. c
New York, Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09857

HYDRAULIC MODEL EXPERIMENT ON THE DIFFUSION DUE TO THE TIDAL CURRENT,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Haruo Higuchi.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D9, p 79-88, 1967. 10 p, 14 fig, 3 ref.

Descriptors: *Estuaries, *Diffusion, *Tidal effects, *Currents (Water), Mixing, Model studies, Dye releases, Tracers, Hydraulic models, Hydraulic similitude, Dispersion, Path of pollutants, Waste water disposal.
Identifiers: Japan.

The diffusion phenomena due to tidal currents in the shallow broad estuaries were studied in a hydraulic model experiment for which Ariake Bay in the Amuta area of Kyushu was used as the prototype. Only the tidal current is taken into account. A model of the northern half of Ariake Bay, of which the length is about 90 km, with a horizontal and vertical scale of 1/2000 and 1/200 respectively, was constructed, and a semidiurnal tide was generated by an automatically controlled pneumatic tide generator. The water levels at 5 stations, the current ellipses at 4 stations, and the flow pattern were measured and compared with those in the prototype. Diffusion from an instantaneous point source and from a continuous point source was investigated mainly by a photographic method. Experiments show that tides and tidal currents are accurately reproduced in the model. The diffusion coefficient evaluated through mixing of the water from Chikugo River with sea water is almost the same as in the prototype. However, the diffusion coefficient evaluated through the rate of increase of the dye patch is about 1/3 of that in the prototype. This may be due to the difference between the flow in the model and that in the prototype. (Knapp-USGS)
W70-09859

DIFFUSIVE PROPERTIES OF INTERFACIAL LAYERS,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.
For primary bibliographic entry see Field 05B.
W70-09867

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
E. Makowski, and G. Grissener.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/12, p 181-190, 1967. 10 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Bottom sediments, *Beaches, *Tracers, *Tracking techniques, Radioisotopes, Radioactivity techniques, Bed load, Littoral drift, Erosion, Sedimentology, Marine geology.
Identifiers: Marine sediments.

The quantitative method of marine sediment tracing involves burying appropriate detectors under the sea bottom. Detectors arranged in this way are covered by a layer of radioactive sediment whose activity is proportional to its mass. Before the labelled sediments are eroded, their initial activity is measured, and then, as the covering is eroded,

easurements are made of the gradual decrease in tivity corresponding to loss of the surface layer of e bottom deposit area under investigation. The acers used in the investigations discussed were atural ones such as Si-31 and artificial ones such activated fragments of sodium glass with Na-24. he proportional dependence of activity on mass as been confirmed for both tracers. This proportionality is very well maintained if a sample of ighly active sediment is introduced into a large ass of inactive sediments. The advantages of this ethod as a possible use of radioisotopes with a ort half-life and a low total activity of the order of few millcuries are discussed. (See also W70-9868) (Knapp-USGS)
W70-09877

FFECT OF EUTROPHY AND DESALINATION N THE PHYTOPLANKTONIC POPULATIONS, IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume; and Centre Universitaire de Luminy, Marseille (France). Laboratoire d'Hydrobiologie Marine.
F. Blanc, and M. Leveau.
English abstract. Marine Biology, Vol 5, No 4, p 283-293, 1970. 14 fig, 6 tab, 16 ref.

Descriptors: *Saline water-fresh water interfaces, Phytoplankton, *Desalination, River flow, Nitrates, Salinity, Sea water, Nutrients, Carbon, Nitrogen, Hydrogen, Phosphates, Diatoms.
Identifiers: Carbon:Nitrogen ratio, Chlorophyll a, Peridiniiae, Rhone River, Mediterranean Sea, Gulf of Fos.

The inflow of the River Rhone into the Gulf of Fos of southern France drastically lowers the salinity of water, augments its concentration of nutrients, and increases as much as 15 times the density of phytoplanktonic organisms in comparison with that of the Mediterranean Sea. The maximum number of cells in water of the gulf is 7.5 million/liter. The high cellular concentration depresses the rate of the relative photosynthesis, if appraised on the basis of chlorophyll a per million cells. Both plant remains and carbonates of fresh water increase the carbon/nitrogen ratio. (Wilde-Wisconsin)
W70-09897

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

NEW SYNTHETIC MEMBRANES FOR REVERSE OSMOSIS DESALINATION,
Arthur D. Little Research Inst., Inveresk (Scotland).
G. Maconochie, and G. Thomson.
Available for sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $0.65. US Office Saline Water Research and Development Progress Report No 533, June 1970. 64 p, 5 fig, 3 tab, 14 ref. OSW Contract No 14-01-0001-1716.

Descriptors: *Membranes, *Reverse osmosis, Permselective membranes, Semipermeable membranes, Laboratory tests, Thin films, Plastics, Research and development, Membrane processes, Permeability.
Identifiers: Synthetic membranes.

The fabrication and reverse osmosis testing of films made from a number of copolymers derived from galactose methacrylate, glyceryl methacrylate, vinyl carbazole and methyl methacrylate are reported and discussed. Synthesis of these materials is described explicitly. By addition of a 'swelling agent' to the solvent mixture, and immersion before completion of drying, 'Loeb type' heterogeneous films were cast. The effects of after-treatment of films were also investigated, consisting of heating at various temperatures in water, and of immersion in aqueous ethanol. A limiting factor in flow performance is the minimum film thickness attainable and thin homogeneous films were prepared by two alternative methods. Lack of toughness in thin sections seemed a possible reason for the difficulty in obtaining very thin films. A quantity of higher molecular weight galactose methacrylate copolymer was prepared. (Knapp-USGS)
W70-09528

BIBLIOGRAPHY OF DESALTING LITERATURE - 1969.
Columbia Software, Inc., Fairfax, Va.

For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.25. US Office of Saline Water Research and Development Progress Report No 552, July 1970. 465 p, 4,925 ref, 2 index. OSW Contract No 14-01-0001-2152.

Descriptors: *Bibliographies, *Desalination, *Information retrieval, *Publications, Saline water, Documentation, Salt extraction, Water chemistry, Absorption, Membrane processes, Separation techniques, Nucleation.
Identifiers: *Desalting literature, *Categorized bibliography.

This comprehensive bibliography is in three sections. Section 1 is categorized with 4,925 citations arranged under the following major subjects: Desalting processes, Chemical recovery processes, Dynamic phenomena, Development status, Membranes, Chemical properties, Water, and Energy sources. Each citation includes a reference number which is assigned serially. Section 2 is an author index with names and authors arranged alphabetically, followed by titles and reference numbers of pertinent citations. Reference numbers can be used to locate the reference in Section 1, where source and date published are shown. Section 3 is a descriptor index arranged alphabetically and with titles of citations and reference numbers given under each descriptor. (Lang-USGS)
W70-09529

3B. Water Yield Improvement

DELINEATION OF LINEAR FEATURES AND APPLICATION TO RESERVOIR ENGINEERING USING APOLLO 9 MULTISPECTRAL PHOTOGRAPHY,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 07B.
W70-09537

AGRICULTURAL IRRIGATION AND SALINE QUALITY OF WATER.

Land and Water Law Review, Vol. 5, p 491-499 (1970). 9 p, 38 ref.

Descriptors: *Irrigation water, *Salinity, *Impaired water quality, *Leaching, Water utilization, Saline water, Irrigation, Water supply, Water demand, Water pollution, Irrigation effects, Water quality control, Legislation, Programs, Administrative agencies, Standards, Salt balance, Soil water, Water pollution sources, Irrigation practices, Pollution abatement, Adoption of practices, Legal aspects, Costs.

Salinity--the concentration of dissolved salts in water--is a major water pollution problem in the West. The main cause of this salinity is leaching of minerals from irrigated land. Much legislation has been enacted to abate pollution, many of which promulgate minimum standards of water quality. These standards, however, often do not provide for control of the major source of salinity--agricultural irrigation. Some states do have legislation which could be interpreted to cover irrigation practices. However, the importance of irrigation to many western states' economy militates against any strong action against present irrigation practices by these states. Improved methods of irrigation, such as use of a machine which would allow only enough water to reach plant roots, with no excess to leach the soil, are beyond the economic resources of most irrigators. While little action is now likely against irrigators who presently cannot afford new irrigation techniques, the increasing magnitude of the problem will eventually force changes in these practices. (Caldwell-Florida)
W70-09787

WATER-SUPPLY STRINGENCIES-FEATURES, ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
For primary bibliographic entry see Field 06B.
W70-09852

WEATHER MODIFICATION POTENTIAL FOR WATER SUPPLY IN THE COLORADO RIVER,
Bureau of Reclamation, Denver, Colo.
Archie M. Kahan.
Paper, Second National Conference on Weather Modification, American Meteorological Society, Santa Barbara, Calif, Apr 1970. 43 p, 9 fig, 2 tab, 19 ref, append.

Descriptors: *Weather modification, Storms, Runoff, Nucleation, Silver iodide, Water resources, Runoff forecasting, *Cloud seeding, *Artificial precipitation, Planning, *Water supply, Atmospheric precipitation, Field investigations, Watersheds (Basins), Public opinion, Public relations, Education, Snowfall, Bibliographies.
Identifiers: Upper Colorado River Basin, Colorado River Pilot Project, San Juan Mountains, Colo.

Weather modification experiments suggest that present-day technology, using silver iodide as the nucleating material, can produce increases of over 200% in snowfall under ideal conditions. An average increase of about 30% seems to be a reasonable long-term expectation. It is estimated that by seeding storms during the winter months only, the 14,200-sq-mi water-producing area of the Upper Colorado River Basin could produce 1,870,000 acre-ft of additional streamflow annually. People problems have been encountered during initial pilot projects. However, as people become aware of the potential value of precipitation augmentation programs, the people problems may well diminish. Precipitation management can be helpful in meeting the growing water needs of the nation. (USBR)
W70-09920

ARIZONA WEATHER MODIFICATION RESEARCH PROGRAM,
Meteorology Research, Inc., Altadena, Calif.
Paul B. MacCready, Jr.
Proceedings of the American Society of Civil Engineers, Journal of Irrigation Drainage Division, Vol 96, No IR2, p 103-110, June 1970. 8 p, 3 fig, 7 ref, append.

Descriptors: *Weather modification, *Cloud seeding, Silver iodide, Atmospheric precipitation, Glaciation, Supercooling, Cumulus clouds, Cloud physics, Radar, Ice, Instrumentation, Aircraft, Nucleation, Field tests, Water resources, Research and development, *Rainfall, Runoff, Meteorology.
Identifiers: *Cloud modification, Skywater Project, Flagstaff (Ariz), Supercooled clouds, Pyrotechnic seeding, Convective clouds.

An interim progress review for the period ending with the fourth summer season at Flagstaff, Ariz, is presented. In 1967, randomized seeding of isolated cumulus clouds was the main experiment. A simple computer model served successfully for test cloud selection and evaluation of results. The experiment demonstrated statistically significant cloud-top height increases (averaging 6000 ft) and approximate doubling of precipitation. Cloud interiors

were probed with an instrumented aircraft. In contrast to events in unseeded clouds, observations of seeded cumuli showed rapid spread of glaciation throughout the clouds. Subsequently, additional buoyancy and organization of the upcurrent, and early shutting off of precipitation growth were noticed. The study in 1967 involved exploratory trials of seeding larger storm systems to organize and stimulate them. In 1968, a program called COOP II brought together the capabilities of several groups to continue the studies, with special emphasis on storm systems and optimizing seeding techniques. (USBR)
W70-09927

ANNUAL AND PERENNIAL BARRIERS IN RELATION TO WIND EROSION AND MOISTURE CONSERVATION,
Agricultural Research Service, Sidney, Mont.
F. H. Siddoway.
Presented at Conservation Tillage Workshop conducted by the Great Plains Agricultural Council, Lincoln, Nebraska, February 27-29, 1968. 21 p, 6 fig, 1 tab, 19 ref.

Descriptors: *Barriers, *Windbreaks, *Great Plains, *Wind erosion, *Water conservation, Precipitation (Atmospheric), Fallowing, Evaporation, Snow, Agriculture, Crop production, Microclimatology.
Identifiers: *Plant-microclimate relationships.

Barriers, whether mechanical or vegetative, invariably alter the microclimate in their vicinity. This results from a combination of factors coinciding with the universal effect of reducing windspeed to the leeward and windward of the barrier. In the Great Plains the primary purposes of the barriers are: (1) Wind erosion control (2) Evaporation reduction (3) Managing snow deposition (4) Crop protection against adverse physical effects of winds. The literature indicates that practically all microclimatological barrier influences in the Great Plains are favorable to plant growth. An equation has been developed, on the basis of the reduced wind speed effect which facilitates the design of predictable barrier erosion control systems. Much evidence indicates maximal water conservation from snow precipitation in the first spring after a crop harvest. This may eliminate the necessity of summer fallowing and consequently reduce wind erosion problems. The resulting annual cropping would offset the disadvantages of land occupancy by the barriers. The major need would be for adequate barrier-spacing design. (Casey-Arizona)
W70-09957

BARRIERS FOR MOISTURE CONSERVATION AND WIND EROSION CONTROL IN THE GREAT PLAINS,
Agricultural Research Service, Sidney, Mont.
F. H. Siddoway.
Presented at the 24th Annual Meeting Soil Conservation Society of America, Colorado State University, Fort Collins, Colorado, August 10-13, 1969. 21 p, 2 fig, 2 tab, 20 ref.

Descriptors: *Barriers, *Windbreaks, *Water conservation, *Great Plains, Semiarid climates, Agriculture, Snowfall.
Identifiers: *Vegetative barriers, *Barrier engineering.

Modifications of windspeed and flow patterns are the primary microclimatic effects of barriers. Reduction of windspeed varies with height multiples of the barrier, distance from the barrier, physical properties of the barrier and wind and ground surface properties. Historically, field barriers in the Great Plains were multiple rows of trees or shrubs. However, these dense barrier belts occupied large amounts of arable land and piled up deep snowdrifts creating water erosion and delaying spring planting. More recently short, single-row, narrowly spaced, barriers have been utilized with better results, particularly in creating more uniform field snow drift distribution under variable wind drift directions. The drier parts of the Great Plains have the most to gain from barrier plantings, but have not yet intensively used them. This is probably because of the rarity of suitable tree species, the expense, difficulty, and long time required for their establishment and their subsequent competition with crop plants. It is suggested that non-tree plant materials be used-shrubs, sorghum, grass, corn. (Casey-Arizona)
W70-09958

PRECIPITATION MODIFICATION IN SEMIARID AND ARID REGIONS,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
In Ecological Effects of Weather Modification: A Problem Analysis, Chapter 3, p 22-33, School of Natural Resources, University of Michigan, May 1969. 26 ref. Bureau of Reclamation, Office of Atmospheric Water Resources, Contract Number 14-06-D-6576.

Descriptors: *Weather modifications, *Ecology, *Habitats, *Semiarid climates, *Precipitation (Atmospheric), Ecosystems, Arid lands, Streambeds, Stream erosion, Vegetation, Wildlife, Animal behavior, Grasslands, Grazing, Ecotypes, Potholes, Cloudseeding, Streamflow, Sedimentation.
Identifiers: *Vegetation mosaics, *Plant succession.

Weather modifications in semiarid and arid areas will be aimed toward increasing precipitation in agricultural and municipal areas and increasing mountain snowfall to augmentdownstream runoff. The effects of these precipitation changes on various ecosystems involved are examined. The species diversities of natural grasslands are remarkably stable as shown by responses to the drought of the 1930's and to artificial precipitation experiments. The dominant species composition varies over time and space with rainfall according to natural vegetational mosaic self-regulating mechanisms, which may also be influenced by grazing intensity and selectivity. Mammalian populations will respond to weather modifications as complex functions of vegetational changes. A crucial point is that weather modification involving cloud seeding is unlikely to alleviate severe droughts since they are associated with air patterns which inhibit cloud formation. The 10-14 inch average annual rainfall range is critical to stream beds since variations on either side of it will effect changes in runoff flow and sediment yield altering stream channel characteristics. (Casey-Arizona)
W70-09959

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
In Ecological Effects of Weather Modification: A Problem Analysis, Chapter 10, p 109-122, School of Natural Resources, University of Michigan, May 1969. 24 ref. Bureau of Reclamation, Office of Atmospheric Water Resources, Contract Number 14-06-D-6576.

Descriptors: *Ecosystems, *Weather modification, *Habitats, *Precipitation (Atmospheric), *Ecology, Humid areas, Semiarid climates, Arid lands, Soil-water-plant relationships, Competition, Plant populations, Climatology.
Identifiers: *Plant communities, *Marginal habitats, *Climatic variability effects, Genetic resources, Extinctions.

An attempt is made to assess the ecological impacts of weather modification purely on the basis of existing fragmentary ecological theory. Plant species are composed of continuous populations normally distributed between environmental extremes and associated with other plants in communities. A change in rainfall may change a community by expediting the invasion of a new species with differing moisture requirements by eliminating an older species, or by changing abundances of species alrea present. The argument that weather modificati will have no biological effects because it will be e tirely within present climatic variability ranges considered fallacious, because the community, a especially its marginal elements will be affected d changes in mean rainfall over time. Different co munities differ in their sensitivity to clima changes. A fixed proportional change in precipi tion will affect humid area plants the least, a area plants more and semiarid plants the most. S ble climax communities and highly disturbed sit tions will be least affected. It is theorized that th plant groups least affected will be living in microc mates less variable than regional macroclimat Animal extinctions are considered unlikely b valuable plant genetic resources may be lost as result of increasing agricultural homogeneity. (S also W70-00140) (Casey-Arizona)
W70-09960

PHYSIOLOGIC COSTS OF SURVIVAL IN TH DESERT,
Aeromedical Research Lab., Holloman AFB, N Mex.
W. C. Kaufman.
In: Physiological Systems in Semiarid Enviro ments, Hoff, C. C. and Riedesel, M. L. (editors),) 177-185, University of New Mexico Press, 1969. fig, 1 tab, 7 ref.

Descriptors: *New Mexico, *Solar stills, *Ar lands, *Water conservation.
Identifiers: *Chihuahuan Desert, *Physiolog costs, *Survival techniques.

The solar still requires expenditures of energy an body water in digging for proper placement. Th physiologic costs of operation were compared t the return from the still in simulated desert survival conditions in New Mexico. Heat production an energy losses were measured in 5 human subject using survival tools at 30 degree centigrad daytime temperatures and 25 degree centigrad nighttime temperatures. Additionally, solar sti production was measured and compared with so moisture content. With soil moisture content abou 30 percent, results showed a return of only 0.1 lite in the first 24 hours whether digging was done a day or night. It was concluded that standard deser precautions involving avoidance of heat stress ar better survival techniques than solar still operation (Casey-Arizona)
W70-09965

3C. Use of Water of Impaired Quality

BENEFICIAL USE OF WASTE HEAT IN AGRICULTURE,
Oregon State Univ., Corvallis. Dept. of Soils.
Larry L. Boersma.
Fifth Annual Water Resources Research Con ference, Feb 3-4, 1970, Washington, D.C., U. S Dept. of Interior, Office of Water Resources Research, June 1970, p 65-73. 7 fig, 2 tab.

Descriptors: *Cooling water, *Nuclear power plants, *Beneficial use, *Thermal Pollution, *Agriculture, Soil temperature, Crop production, Crop response, Plants growth, Farms, Root development.
Identifiers: *Subsurface heat application.

Heat may stimulate as well as harm growth and development of plants. In geographical regions where soil temperature can limit growth, artificial soil warming becomes attractive. Nuclear reactor cooling water may be expected to have a temperature range of 90 to 100 degrees. A sub-surface application of the heat by circulating the warm water through a network of buried pipes was considered feasible. A field project was conducted. It emphasized evaluation of crop response to increased soil temperatures and a study of rate of heat loss growth rates and yields of tomatoes,

strawberries, corn, alfalfa, bush beans, and lima beans growing on heated plots are measured and compared with identical plantings growing on unheated ground. The project has shown promise of success. The problems remained to be studied are: (1) a very dry core around the heat source which was particularly difficult to rewet, (2) thermal conductivity differed from soil to soil, (no system will apply universely), (3) the effect of heat application over a long period on soil. (Hsieh-Vanderbilt)
W70-09597

SALT TOLERANCE OF CROPS AT GERMINATION STAGE,
Udaipur Univ., (India). Agricultural Experiment Station.
G. L. Maliwal, and K. V. Paliwal.
Annals of Arid Zone, Vol 8, No 1, p 109-125, March 1969. 82 ref.

Descriptors: *Soil-water-plant relationships, *Saline soils, *Saline water, *Salt tolerance, *Germination, Irrigation practices, Irrigation water, Toxicity, Root zone, Arid lands, Semiarid climates, Anions, Cations, Sodium, Calcium, Magnesium, Potassium, Chlorides, Sulfates, Osmotic pressure, Alkalinity, Temperature, Soil moisture, Seed treatment, Cereal crops, Legumes, Rice, Cotton, Sugar beets.
Identifiers: *India, *Sodic soils, *Varietal differences, *Ion antagonism, Bajra, Maize, Jowar, Mung, Paddy.

In studying yields of crop plants under saline conditions, particular attention must be paid to germination since it is the crucial limiting factor. A saline substrate may affect germination in 2 possible ways: (1) Soil osmotic pressure build-up resulting in seed water imbalances (2) toxic effects of certain salts. In an effort to separate these effects the literature is reviewed with respect to relative salt tolerances of various crops, particularly legumes and cereal grains, and relative toxicities of differing salts and salt concentrations to differing plants and plant varieties. It appears that crop salt tolerances may vary from crop to crop, among varieties and from germination through different growth stages. Detrimental salinity effects increase at lower soil moisture levels and at higher soil temperatures. Presoaking of seeds in fresh water and leaching or preirrigation of saline soils are 2 methods whereby salinity effects on germination may be lessened. (Casey-Arizona)
W70-09954

3E. Conservation in Industry

INDUSTRIAL USE AND COMMUNITY SUPPLIES OF WATER IN ALABAMA,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W70-09521

SURVEY OF WATER UTILIZATION AND WASTE CONTROL PRACTICES IN THE SOUTHERN PULP AND PAPER INDUSTRY,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05D.
W70-09668

THE TRANSFER OF WATER RIGHTS FOR USE IN THE OIL INDUSTRY,
For primary bibliographic entry see Field 06E.
W70-09779

3F. Conservation in Agriculture

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09518

WATER BUDGET ACCOUNTING ON TWO CORN-CROPPED WATERSHEDS,
Agricultural Research Service, Brookings, S. Dak.
For primary bibliographic entry see Field 02D.
W70-09532

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 02G.
W70-09574

EVAPORATION FROM BARE SOIL AND THE WAYS OF REDUCING IT,
Agrophysical Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02G.
W70-09575

WATER MOVEMENT AND USE OF PEAT SOILS IN LOWLAND SWAMPS OF THE U.S.S.R.,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09583

USE OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS UNDER SPRINKLING IRRIGATION IN ARID ZONES,
All-Union Scientific Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09584

WATER MOVEMENT AND ITS UTILIZATION BY PLANTS UNDER THE DEEP WATER STORAGE IN SOIL BY USING OFF-SEASON IRRIGATION,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09585

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02D.
W70-09721

SURVEY OF SEWAGE UTILIZATION FOR AGRICULTURAL PURPOSES IN ISRAEL,
Israel Water Commission.
For primary bibliographic entry see Field 05D.
W70-09760

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09820

INFLUENCE OF TRANSPIRATION SUPPRESSANTS, SPRINKLER IRRIGATION AND MOISTURE LEVELS ON TRANSPIRATION AND EVAPOTRANSPIRATION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 02D.
W70-09830

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1963,
Agricultural Research Service, Washington, D.C. Soil and Water Research Div.
For primary bibliographic entry see Field 02E.
W70-09851

INFILTRATION EQUATIONS FROM RATE-OF-ADVANCE DATA,
Saskatchewan Univ., Saskatoon.
For primary bibliographic entry see Field 02G.
W70-09930

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
For primary bibliographic entry see Field 02D.
W70-09964

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME I - INTRODUCTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09511

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.
For primary bibliographic entry see Field 06A.
W70-09513

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-C - ALLOCATION PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09514

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-D - STAGE DEVELOPMENT PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME III - DATA MANAGEMENT.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09516

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME IV - USERS MANUAL.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09517

URBAN STORM DRAINAGE CRITERIA MANUAL FROM DENVER,
Wright-McLaughlin Engineers, Denver, Colo.
For primary bibliographic entry see Field 08A.
W70-09534

FLOOD PLAIN INFORMATION, BRAZOS AND BOSQUE RIVERS, WACO, TEXAS.
Corps of Engineers, Fort Worth, Tex.

U S Army Corps of Engineers Flood Plain Report, May 1970. 39 p, 8 fig, 24 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Brazos River (Tex), Waco (Tex), Bosque River (Tex), Standard project flood, Intermediate regional flood.

Flooding of the Brazos and Bosque Rivers, Waco, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09536

IMPROVED METHODS FOR PLANNING OF THERMAL DISCHARGES BEFORE SITE AQUISTION WITH A SPECIFIC CASE EXAMPLE ON THE COLUMBIA RIVER,
Battelle Memorial Inst., Richland, Wash.
R. T. Jaske, W. L. Templeton, J. R. Eliason, and J. C. Sonnichsen.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/46. 32 p, 14 fig, 4 tab, 8 ref. Preprint.

Descriptors: *Computer models, *Thermal pollution, *Columbia River, Power plants, Mixing, Computer programs, Estuarine environment, Water temperatures, Nuclear powerplants, Feasibility studies, Velocity, Flow, Cross-sections, Dispersion, Effluents, Meteorological data, Advection, Grand Coulee Dam.
Identifiers: *COLHEAT, Isopleths.

The highly flexible computation system COL HEAT has been developed and extended for use in estimating interrelated physical effects in estuaries and rivers with highly transient flow conditions. This computer simulation model permits detailed planning of discharges in advance for single and multiple plant locations of overlapping complexity limited only by the accuracy of the input data base. Computer generated illustrations of concentration isopleths are included in the presentation; currently threshold limits of detectability of dye using this method are less than 0.05 ppb, for below visible limits. A special model which relates the hydraulic effects at the point of discharge to thermal tolerances in fish has been developed. The application of this method to a practical case problem was accomplished in work supporting a licence application for a direct cooled reactor plant at Columbia River Mile 78. The predictive needs of this site are very complex because of flow reversals. Based on extensive field data for determining modeling coefficients applicable to the river reach, and prediction of appropriate concentration gradients for the mixed effluent, siting feasibility was recommended. (Osborne-Vanderbilt)
W70-09613

UNDERFLOW PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Metropolitan Sanitary District of Greater Chicago, Ill. Dept of Public Works and Buildings.
For primary bibliographic entry see Field 05D.
W70-09619

THE CHAMIZAL,
International Boundary and Water Commission, El Paso, Tex.
Joseph F. Friedkin.
In: Water Spectrum, Issues, Choices, Actions, Vol. 2, No. 2, p 25-32, (Summer) 1970. 14 photo.

Descriptors: *Rio Grande, *Boundary disputes, *Canal construction, *Governments, *Coordination, *Water management (Applied), Cost sharing, Engineering, Flood control, Avulsion, Area redevelopment, Texas, Mexico.
Identifiers: *International Boundary and Water Commission, *International Cooperation, El Paso (Texas), Juarez, Chihuahua.

On December 13, 1968, a river that had kept the U.S. and Mexico involved in diplomatic dispute for over 100 years, was rechanneled into a concrete-lined girdle that established a new border at the point where El Paso, Texas, meets Juarez, Chihuahua. The International Boundary and Water Commission, United States and Mexico, a group of international water resource managers and engineers, were responsible. The solution to the problem of the shifting Rio Grande involved two major steps: (1) diplomatic agreement on a permanent boundary, and (2) solutions to the technical and social problems resulting from the new boundary. These problems included encasement of the channnel in concrete; demarcation of the new boundary by topographic survey; construction of five new bridges; compensation and resettlement of dispossessed property owners; and the relocation and construction of new border facilities, railroad lines and interchange yards, and the Bureau of Reclamation's irrigation canal. A program of border improvement including cultural and recreational facilities was also initiated. Engineers and planners from both sections of the Commission worked together and the responsibility and costs of construction were shared equally. The Chamizal project is a monument to International cooperation. In addition the International Boundary and Water Commission is providing international flood control works for urban and irrigation developments along the border, optimum feasible storage, and conservation and regulation of the Rio Grande for utilization by the peoples of the two countries. (Marriott-Chicago)
W70-09639

OPERATION FORESIGHT: A VALUABLE PRECEDENT,
Corps of Engineers, North Carolina Div.
Robert M. Tarbox.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, Summer 1969, p 19-26. 11 photo.

Descriptors: *Flood control, *Flood protection, *Flood forecasting, Flood proofing, Warning systems, Flood damage, Levees, Dikes, Damages, Communication, Dredging, Channel improvement.
Identifiers: *'Operation Foresight', Emergency preventive measures, U.S. Army Corps of Engineers.

An account of the activities prior to the actual start of the floods in the Spring of 1969, that led to the unprecedented use of funds on measures to prevent damages. During these operations, North Central Division, spent about $11.9 million which contributed to the prevention of about $106 million in flood damages, as well as inestimable amount of heatbreak and anguish. Under special directive from the President, Corps funds, personnel, equipment, supplies and other resources were made available for full-scale preventive measures. Under a program which the Office of Emergency Preparedness named 'Operation Foresight' the Corps was a principle agency representing the Federal Government. Endangered communities welcomed the offered assistance and provided rights of way, labor, and other community resources. Maximum cooperation was also provided by local, State and Federal agencies in the 26 states in the Snowmelt path. The program included estimations of flood volume, inspection of existing flood control structures, checking of known danger areas, establishment of emergency communications, distribution of literature, flood training, construction of emergency dikes and levees, deepening of channels, experimentation with new materials, and coordination of all involved agencies. (Marriott-Chicago)
W70-09644

URBAN RENEWAL ENGAGES A PARTNER,
Waterloo, Iowa.
Lloyd L. Turner.
Water Spectrum, Issues, Choices, Actions, Volum 1, Number 1, Summer 1969, p 3-9. 8 photo.

Descriptors: *Urban renewal, *Flood control, *Area redevelopment, Multiple purpose projects, City planning, Aesthetics, Recreation, Economics, Benefits, Indirect benefits, Land use, Dredging, Channeling, Zoning, Urbanization, Iowa.
Identifiers: Total planning approach, Waterloo (Iowa).

An abstract written by the Mayor of Waterloo, Iowa, describing that city's approach to two major problems--severe yearly flooding and a large area of slum and blight, the result of unplanned growth in the flood plain. In order to solve the problems of urban redevelopment and flood control, the Westfield-Virden Project was conceived which combined these two originally separate programs into one program. A little more than two miles of riverfront and 1,500 acres of land behind it are involved in the program which hopes to be a model commercial-industrial complex offering improved economy, aesthetic satisfaction and recreational opportunities as well as flood protection and control. Included in the project are plans for a levee serving double function as a highway; re-routing of Black Hawk Creek; rechanneling and clearing Cedar river, using the dredge material as landfill; installation of a new movable dam; clearing of blighted areas; and rezoning of land to allow for industrial expansion. Plans have also been made for use of a sanitary landfill as part of the redevelopment program. Benefits from the program are indirect as well as direct. The expansion of industry will open up some 15,000 new jobs and benefit the local economy by about 240 million a year. Waterloo demonstrates the advantages of a total planning approach and may set an example for future planning. (Marriott-Chicago)
W70-09646

SOME HYDROLOGIC AND BIOLOGIC ASPECTS OF THE BIG CYPRESS SWAMP DRAINAGE AREA, SOUTHERN FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
H. Klein, W. J. Schneider, B. F. McPherson, and T. J. Buchanan.
U S Geological Survey Open-file report 70003, May 1970. 94 p, 19 fig, 4 tab, 20 ref.

Descriptors: *Water resources, *Land development, *Urbanization, *Swamps, *Florida, Water quality, Aquifers, Estuaries, Ecology, Canals, Drainage, Saline water intrusion.
Identifiers: *Big Cypress Swamp, *Everglades National Park (Florida).

This report shows the importance of the Big Cypress in maintaining an adequate water supply

for (1) the Everglades National Park; (2) the expanding population of southwestern Florida, and (3) the adjacent estuaries which constitute nurseries for fish, some of which are commercially important. Hydrological information defining the boundaries of Big Cypress Swamp and its subregions on which Everglades National Park depends for its water supply will assist in predicting effects of alternative land uses within Big Cypress Swamp on the ecology of the Everglades National Park. (Woodard-USGS)
W70-09704

USE OF THE HYDRO-INTEGRATOR FOR STUDYING THE FIRST STAGE OF FILTRATION FROM IRRIGATION CANALS,
All-Union Scientific Research Institute for Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09725

FORMATION OF INFILTRATION FLOW FROM CANAL UNDER DEEP OCCURRENCE OF GROUNDWATER,
All-Union Scientific and Research Institute of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09726

GROUNDWATER POTENTIAL AND SCOPE OF STUDY OF WATER MOVEMENT IN UNSATURATED ZONE IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
For primary bibliographic entry see Field 02G.
W70-09729

HORIZONTAL SEEPAGE THROUGH UNCONFINED AQUIFERS TAKING INTO ACCOUNT FLOW IN THE CAPILLARY FRINGE,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 02G.
W70-09730

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.
For primary bibliographic entry see Field 05G.
W70-09741

MAGNOLIA APARTMENTS, INC V HANES (CLAIM OF DAMAGE CAUSED BY INCREASED FLOW FROM UPHILL PROPERTY).
For primary bibliographic entry see Field 06E.
W70-09783

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
For primary bibliographic entry see Field 06F.
W70-09785

REPORT TO THE CITY OF FLINT, MICHIGAN ON SANITARY AND STORM SEWER SYSTEMS.
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 05G.
W70-09797

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09798

POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09799

FLOOD PLAIN INFORMATION, PARKER CREEK, MARSHALL, TEXAS.
Corps of Engineers, Fort Worth, Tex.

U S Army Corps of Engineers Flood Plain Report, April 1970. 33 p, 7 fig, 13 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Marshall (Texas).

Flooding of Parker Creek, Marshall, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09845

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, ORANGE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

U S Army Corps of Engineers Flood Plain Report, April 1970. 32 p, 9 fig, 7 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Florida, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange County (Fla), Standard project flood, Intermediate regional flood.

Flooding of the Little Wekiva River, Orange County, Florida is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09846

RAULS V COSTNER (DRAINAGE DISTRICT'S LIABILITY FOR FLOOD WATERS CAUSED BY ERECTION OF NEW LEVEE).
For primary bibliographic entry see Field 06E.
W70-09895

KENTUCKY GAME AND FISH COMM'N v BURNETT (STATE FISH COMMISSION'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERECTION OF DAM FOR FISH HATCHERY).
For primary bibliographic entry see Field 06E.
W70-09913

BENTONITE SEALING METHODS COMPARED IN THE FIELD,
Bureau of Land Management, Prineville, Oreg; and Agricultural Research Service, Reno, Nev.
Myron B. Rollins, and Anthony S. Dylla.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 193 203, June 1970. 11 p, 8 tab, 8 ref, append.

Descriptors: *Bentonite, Methodology, Field tests, *Reservoirs, *Reservoir leakage, *Sealants, *Soil sealants, Blankets, Seepage, Sands, Protective coatings, Linings, Construction costs, Irrigation canals, Costs, Buried membranes, Clays.
Identifiers: *Small reservoirs, *Small impoundments, *Seepage control.

Twelve small reservoirs were constructed at each of 2 sites in western Nevada to test methods of sealing with bentonite. Utah bentonite was installed as the following types of seals: (1) waterborne-harrowed, (2) waterborne-over-a-gravel surface, (3) surface blanket, (4) buried blanket, and (5) buried membrane. The waterborne-harrowed seals were short lived. The waterborne seals on reservoirs with graveled surfaces were effective only slightly longer, becoming ineffective after the third season. The 4-in. surface blanket seals were more durable, their effectiveness lasting about 5 seasons. The buried blanket and buried membrane seals proved to be the best, retaining 60% effectiveness 6 yr after installation. Costs of bentonite sealing varied from $0.20 to $1.30/sq yd of soil surface, and are comparable with other methods of sealing, such as plastics. (USBR)
W70-09928

KYLE V ST FRANCIS LEVEE DIST (LEVEE DISTRICT'S LIABILITY FOR WATER DAMAGE CAUSED BY INTERFERENCE WITH SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W70-09940

MORTON V BOROUGH OF DORMONT (CITY'S LIABILITY FOR DAMAGE CAUSED BY INCREASE IN NATURAL FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W70-09991

GULF OIL CORP V THE BALTIMORE (DREDGE COMPANY'S LIABILITY FOR OBSTRUCTION OF NAVIGABLE CHANNEL).
For primary bibliographic entry see Field 06E.
W70-09995

GALLERANI V UNITED STATES (DAMAGE TO WELL FROM CANAL IMPROVEMENT).
For primary bibliographic entry see Field 06E.
W70-09996

BOARD OF TRUSTEES V BOARD OF SUPR'VSRS (COMPULSORY CONTRIBUTION BY DRAINAGE DISTRICTS FOR MAINTENANCE OF COMMON FACILITIES).
For primary bibliographic entry see Field 06E.
W70-10006

MAYOR AND CITY COUNCIL OF HAVRE DE GRACE V MAXA (CITY'S LIABILITY FOR DAMAGES TO RIPARIAN OWNER CAUSED BY NEGLIGENT CONSTRUCTION OF RETAINING WALL).
For primary bibliographic entry see Field 06E.
W70-10010

WILLIS V UNITED STATES (COMPENSATION FOR FLOODING OF RIPARIAN LAND CAUSED BY FEDERAL DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-10012

MUTUAL CHEMICAL CO OF AMERICA V MAYOR AND CITY COUNCIL OF BALTIMORE (RELATIVE BULKHEAD--FILL RIGHTS).
For primary bibliographic entry see Field 06E.
W70-10015

GOODMAN V UNITED STATES (DAMAGE FROM GOVERNMENT'S NAVIGATION PROJECT).
For primary bibliographic entry see Field 06E.
W70-10016

HUMBOLDT LOVELOCK IRR LIGHT AND POWER CO V SMITH (STATE REGULATION OF RIVER WATER DIVERSION).
For primary bibliographic entry see Field 06E.
W70-10017

HAGIE V LINCOLN LAND CO (CHARGE OF POINT OF DIVERSION FROM STREAM CLAIMED TO BE ABANDONMENT OF RIGHT TO DIVERT).
For primary bibliographic entry see Field 06E.
W70-10021

4B. Groundwater Management

WASTE DISPOSAL AND EARTHQUAKES AT THE ROCKY MOUNTAIN ARSENAL, DERBY, COLORADO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05E.
W70-09539

UNDERGROUND WASTE DISPOSAL,
Gurnham and Associates, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05E.
W70-09543

SOME CONSIDERATIONS IN UNDERGROUND WASTE WATER DISPOSAL,
Ohio River Valley Water Sanitation Commission, Cincinnati; and Missouri Univ., Columbia. Dept. of Geological Engineering.
For primary bibliographic entry see Field 05E.
W70-09549

GROUNDWATER RESOURCE EVALUATION,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02F.
W70-09551

SUMMARY RECORDS OF SUPPLY WELLS AND TEST WELLS IN THE POST HEADQUARTERS AREA, WHITE SANDS MISSILE RANGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 02F.
W70-09684

HYDROGEOLOGICAL MAPS OF KOREA - VOL 1, ANSEONG RIVER BASIN, (KOREAN),
Geological Survey of Korea, Seoul.
For primary bibliographic entry see Field 02F.
W70-09706

ARTIFICIAL RECHARGE OF SUBTERRANEAN AQUIFERS,
Akademiya Nauk SSSR, Moscow. Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii.
G. Bogomolov, and Yu Bogomolov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 879-884, 1968. 6 p, 1 fig, 31 ref.

Descriptors: *Artificial recharge, *Aquifers, *Hydrogeology, Water wells, Induced infiltration, Water management (Applied), Water resources development, Water Supply.

Based on the analysis of natural conditions, a characteristic of main hydrological parameters determining the suitability of some regions for artificial groundwater recharge at the expense of infiltration of atmospheric precipitation and waters of surface-stream flow is given. Data on optimal distances of infiltration zones from areas of location of water-catchment systems are reported for different types of rocks as well as the estimation of the efficiency of water-catchment systems. (See also W70-09728 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09727

ARTIFICIAL RECHARGE FOR GROUNDWATER STORAGE IN THE UNSATURATED ZONE,
Food and Agricultural Organization of the United Nations, Rome (Italy).
R. P. Ambroggi.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 884-885, 1968. 2 p, 1 ref.

Descriptors: *Artificial recharge, *Aquifers, *Hydrogeology, Water wells, Induced infiltration, Water spreading, Water management (Applied), International Hydrological Decade, Water resources development, Water supply.
Identifiers: Research recommendations.

A brief review is given of the requirements of artificial recharge for groundwater storage. Some examples are given of the application of artificial recharge in the unsaturated zone. It is conducted that the International Hydrological Decade should provide an opportunity to further study of groundwater storage in the unsaturated zone by means of artificial recharge through spreading grounds. (See also W70-09729 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09728

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W70-09732

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES,
Alabama Univ., University, Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09771

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX A: DESIGN AND COST OF LIQUID-WASTE DISPOSAL SYSTEMS,
Alabama Univ., University, Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09772

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID INDUSTRIAL WASTES, FORMATION WATERS, AND MINERALS IN SALAQUIFERS OF ALABAMA; PART II, LABORATORY STUDY OF SELECTED RESERVOIR ROCKS,
Alabama Univ., University. Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09773

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX C: STRATIGRAPHY OF ALABAMA (WITH A SECTION ON PHYSIOGRAPHY),
Alabama Univ., University. Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09774

4C. Effects on Water of Man's Non-Water Activities

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY,
AVCO Economic Systems Corp.
For primary bibliographic entry see Field 05B.
W70-09615

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05B.
W70-09637

KNOX COUNTY V MONCIER (INVERSE CONDEMNATION SUIT BROUGHT BECAUSE OF FLOODING CAUSED BY HIGHWAY CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09676

EFFECTS OF DEICING SALTS ON WATER QUALITY AND BIOTA-LITERATURE REVIEW AND RECOMMENDED RESEARCH,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 05C.
W70-09705

RUST V CITY OF NEWPORT (CITY'S LIABILITY FOR WATER DAMAGE TO PROPERTY ALONG NEW ROAD CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09931

CHICK SPRINGS WATER CO V STATE HIGHWAY DEPT (STATE'S LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT CULVERT CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09985

HICKS V ANDERSON (LANDOWNER'S RIGHT TO HAVE PROPERTY CONDEMNED AFTER DAMAGE RESULTS FROM STATE ACTION).
For primary bibliographic entry see Field 06E.
W70-10007

4D. Watershed Protection

TESTS OF THEORETICAL CALCULATIONS OF DISCHARGES OF SUSPENDED SEDIMENT IN PLAINS RIVERS,
For primary bibliographic entry see Field 02J.
W70-09910

STAMFORD DOCK AND REALTY CORP V CITY OF STAMFORD (CITY'S LIABILITY FOR SEDIMENT DISCHARGE FROM STORM DRAINS AND SEWERS).
For primary bibliographic entry see Field 06E.
W70-09988

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

THE APPLICATION OF LASER IONIZATION MASS SPECTROMETRY TO THE IDENTIFICATION OF ORGANIC SALTS IN POLLUTED WATER,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
F. J. Vastola, and R. O. Mumma.
Available from NTIS as PB-193 797, $3.00 in paper copy, $0.65 in microfiche. Institute for Research on Land and Water Resources, Research Project Technical Completion Report, University Park, Pa., Aug 1969. 6 p, 1 tab, 2 fig, 1 append. Contract No 14-01-0001-1858. OWRR Project A-0190PA (1).

Descriptors: *Pollution abatement, *Pollutant identification, *Analytical techniques, *Detergents, *Ionization, Sulfates, Ions, Sulfonates, Organic compounds.
Identifiers: *Laser ionization, *Mass spectrometry, *Detergent residues, Organic salts, Organic sulfonates, Organic compounds.

Laser ionization mass spectrometry was demonstrated to be applicable for the analysis of organic salts typical of those salts found in polluted waters. Various methods of introducing the sample into the mass spectrometer were investigated. Procedures were developed for the analysis of microgram samples and compilation of spectra of sulfonates, thiosulfates, and sulfates was initiated. (See also W70-09523) (Sink-Penn State Univ)
W70-09522

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION,
Pennsylvania State Univ., University Park. Dept. of Materials Science.
F. J. Vastola, R. O. Mumma, and A. J. Pirone.
Organic Mass Spectrometry, Vol 3, p 101-104, 1970. 1 tab, 1 fig, 2 ref. OWRR Project A-019-PA.

Descriptors: *Pollution abatement, *Pollutant identification, *Analytical techniques, *Detergents, *Ionization, Sulfates, Ions, Sulfonates, Organic compounds.
Identifiers: *Laser ionization, *Mass spectrometry, *Detergent residues, Organic salts, Organic sulfonates, Organic compounds.

Alkali salts of 1-hexyl sulfonate were ionized by laser irradiation and the positive ions were analyzed by time-of-flight mass specrometry. The sodium, potassium, rubidium and cesium salts produce relatively simple spectra. The major organic ions observed are due to the salt plus a cation or the dimer plus a cation. No molecular or fragment ions were detected. The instrumentation and the method of interpreting these data are described. (See also W70-09522)
W70-09523

REPORT ON THE FEDERAL-STATE-INDUSTRY COOPERATIVE SAVANNAH RIVER WATER QUALITY STUDIES, 1956-1965.
Public Health Service, Atlanta, Ga. Savannah River Advisory Board.
For primary bibliographic entry see Field 05G.
W70-09552

POTOMAC RIVER WATER QUALITY NETWORK, COMPILATION OF DATA-WATER YEAR 1969.
Interstate Commission on the Potomac River Basin, Washington, D.C.
Interstate Commission on the Potomac River Basin Data Compilation Report, 1969. 92 p, 2 fig, 3 map.

Descriptors: *Data collections, *Water quality, Biochemical oxygen demand, Suspended load, Turbidity, Data storage and retrieval, Coliforms, Dissolved oxygen, Algae, Nutrients, Solutes, Chlorides, Calcium, Carbonates, Phosphates.
Identifiers: Potomac River basin.

Water quality data from the Potomac River basin are summarized. The water statistics are obtained from samples taken at 80 stream sampling points in the basin. The samples were taken and analyzed by agencies, industries and municipalities. An explanation of parameters is included. The data obtained this water year were stored in the Federal Water Pollution Control Administration computer-Storet. (Knapp-USGS)
W70-09557

CHLORINATED HYDROCARBONS IN MARINE ECOSYSTEMS,
California Univ., Berkeley. Inst. of Marine Resources.
R. W. Risebrough.
In: Chemical Fallout-CURRENT RESEARCH ON PERSISTENT PESTICIDES, Proceedings Publication of Rochester Univ. Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 5-23, 1969. 19 p, 4 tab, 39 ref. NSF Grant GP 6362.

Descriptors: *Pesticide drift, *Pacific Ocean, *Pesticide residues, *Water pollution sources, *Chlorinated hydrocarbon pesticides, DDT, Dieldrin, Water pollution effects, Toxicity, Path of pollutants, Environmental effects, Ecology.
Identifiers: Chlorinated hydrocarbons.

Polychlorinated biphenyls, chlorinated hydrocarbons which are extensively used in industry and agriculture, are now widely distributed in marine ecosystems of the Pacific Ocean. Birds contain higher concentrations of these chemicals than fish; tissues of the peregrine flacon have contained the highest amounts which have so far been recorded. The polychlorinated biphenyls have not been detected in samples of airborne particulates but their observed distribution in the sea indicates that they are dispersed by wind currents and that their fallout pattern is similar to that of the DDT compounds. Their effects upon natural populations, including man, are as yet unknown. Among the chlorinated hydrocarbon 'pesticides', DDE is accumulating in significant amounts in marine food chains, and is also present in highest concentrations in marine birds, especially the procellariiform species. Its distribution indicates that coastal areas are not the primary sources of contamination. Wind transport can account for the observed distribution of DDT compounds in California waters. (See also W70-09559) (Knapp-USGS)
W70-09560

THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
P. A. Butler.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceedings Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 205-220, 1969. 16 p, 3 fig, 3 tab, 8 ref.

Descriptors: *Pesticide residues, *Persistence, *Estuarine environment, *Pesticide toxicity, *Environmental effects, DDT, Pesticide drift, Water pollution effects, Chlorinated hydrocarbon pesticides, Water pollution sources, Path of pollutants, Ecology, Aquatic environment, Estuaries.
Identifiers: Estuarine fauna.

A nationwide program was initiated in 1965 to monitor residues of ten synthetic, chlorinated hydrocarbon pesticides in estuarine populations of fish and shellfish. About 160 stations have been established where samples are collected at thirty-day intervals for analysis by gas chromatography with electron capture. The summarized data show that estuarine pollution levels reflect the intensity of agriculture in the associated river basin. Experiments were undertaken to determine effects of a DDT-contaminated diet on fish and crustaceans. There was essentially no correlation between the amount of DDT residue and the size of the animal or the length of time it fed on the contaminated food. The experimental and monitoring data indicate that existing widespread pesticide pollution is causing significant decreases in productivity of estuarine populations of fish and shellfish. Resistant surviving animals are instrumental in concentrating and transmitting lethal amounts of pesticide residues in the food web. (See also W70-09559) (Knapp-USGS)
W70-09564

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Donald A. Bahnick, Joseph W. Horton, and Ronald K. Roubal.
Available from the NTIS as PB-194 030, $3.00 in paper copy, $0.65 in microfiche. Center for Lake Superior Environmental Studies, Contribution No 16 (1970). 15 p, 4 fig, 4 ref. OWRR A-023-WISC (4).

Descriptors: *Water quality, Wisconsin, Color, Chemical oxygen demand, Rainfall, Nitrogen, Phosphorus, Hydrogen ion concentration, *Pollutant identification, Dissolved oxygen, Copper, Water chemistry, *Water analysis.
Identifiers: Bois Brule River, Poplar River, Specific conductance, Total solids.

A study of certain chemical parameters for the Poplar River, Wisconsin, Watershed is presented. Parameters determined were, nitrogen, phosphorus, copper, dissolved oxygen, chemical oxygen demand, specific conductance, color value, total solids, and pH. The collected data were correlated with rainfall and terrain in the drainage basin of the Popular River. These results were compared with a similar study of the Bois Brule River, a neighboring stream, which was studied in 1968. (See also W70-09675)
W70-09674

MERCURY IN THE MARINE ENVIRONMENT,
Scripps Institution of Oceanography, La Jolla, Calif.
David H. Klein, and Edward D. Goldberg.
Environmental Science and Technology, Vol 4, No 9, p 765-768, September 1970. 4 p, 3 fig, 1 tab, 17 ref.

Descriptors: *Water pollution sources, *Poisons, *Heavy metals, Chemical wastes, Sea water, Path of pollutants, Pollutant identification, California.
Identifiers: Mercury, Methyl mercury.

Mercury levels in marine sediment and three marine organisms--crab, whelk, and rock scallop--are 500 times or more greater than those in seawater of the California coastal environment of La Jolla and Palos Verdes. The subject of mass poisoning in aquatic life of recent note, mercury is released to the environment at an estimated rate of 4000-5000 tons annually. Higher values of mercury are found in sediments near sewer outfalls as compared to similar deposits further removed. The dispersion of this toxic pollutant by marine organisms and by man has already had serious consequences. (Knapp-USGS)
W70-09677

THE CHEMISTRY OF THE INTERSTITIAL WATER AS A MEASURE OF CONDITIONS IN A SANDY BEACH,
National Inst. for Water Research, Congella (South Africa).

W. D. Oliff, B. D. Gardner, W. D. Turner, and J. B. Sharp.
Water Research, Vol 4, No 2, p 179-188, February 1970. 10 p, 1 fig, 6 tab, 6 ref.

Descriptors: *Path of pollutants, *Biodegradation, *Beaches, Sands, Water pollution effects, Surf, Aeration, Dissolved oxygen, Oxygen demand, Sewage, Water pollution sources.
Identifiers: South Africa.

Interstitial waters of beaches were analyzed to determine the ability of the beach and surf zone to assimilate sewage. Water samples were drawn from about three below the surface of the beaches, about mid-way between low and high tide marks in the swash zone during low water of spring tides. The sea water samples were taken from the surf at the same place and time. Analyses were made for dissolved oxygen, salinity, pH, nitrite, ammoniacal and Kjeldahl nitrogen, and total phosphorus content. Two groups of experiments were performed. The first was done on a beach 20 mi. south of Durban, S. Africa, around a factory effluent outfall containing about 250 mg/liter of ammoniacal N. The second group covered three pairs of stations in the Durban area which were sampled at fortnightly intervals for 6 months. The first pair was at Brighton Beach, apparently a normal beach. The second pair was 100 yd from the Umgeni river mouth, under the influence of a moderate load of pollution. The last pair was 100 ft south of the mouth of the Umlaas River Canal which is highly polluted with industrial and domestic waste. The beaches, even those which were somewhat polluted, have all been apparently normal and aesthetically unobjectionable. The sea and the local beaches can accept greater loads of enriching material than encountered in these studies. (Knapp-USGS)
W70-09679

APPLICATIONS OF FLUORESCENCE SPECTROSCOPY TO FUNDAMENTAL PROBLEMS IN INSECT BIOCHEMISTRY,
Georgia Univ., Athens. Dept. of Entomology.
Chester M. Himel, and Richard T. Mayer.
Journal of Georgia Entomology Society, Vol 5, No 1, p 31-38, January 1970. 8 p, 2 fig, 1 tab, 21 ref. FWQA Grant 16020 EAO.

Descriptors: *Insecticides, *Biochemistry, *Enzymes, *Inhibitors, *Tracers, Analytical techniques, Metabolism, Pigments, Spectrophotometry, Spectroscopy, Fluorescence, Organic compounds, Insects, Animal physiology.
Identifiers: Fluorescence spectroscopy, Insect biochemistry.

Intrinsic fluorescence of enzymes which contain tryptophan can be used to study their conformation and dynamics. Fluorescent molecules can also be designed and synthesized that will bind (reversibly or irreversibly) with enzymes and other biopolymers. The fluorescence resulting here is referred to an extrinsic fluorescence. When the spectroscopic response (fluorescence excitation, emission and quantum yield) is a function of the environment of the bound fluorescent moiety, the fluorescent moiety is termed a fluorescent probe. Intrinsic and extrinsic fluorescent probes are discussed. Examples are given of designed, active-site-directed, reversible enzyme inhibitors which act as fluorescent probes. Such applications of fluorescence spectroscopy constitute a new and potentially very important methodology in insect biochemistry that is pertinent to our understanding of the mode of action of insecticides. (See also W70-06754; W70-09683 and W70-09770) (Knapp-USGS)
W70-09682

5-DIMETHYLAMINONAPHTHALENE-1-SULFONIC ACID (DANS ACID) AS STANDARD FOR QUANTUM YIELD OF FLUORESCENCE,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05C.
W70-09683

ANALYSIS OF MULTICOMPONENT ORGANIC MIXTURES IN AQUEOUS MEDIA BY PYROLYSIS,
Rocketdyne, Canoga Park, Calif. Research Div.
Ihor Lysyj, Kurt H. Nelson, and Steve R. Webb.
Summaries in French and German. Water Research, Vol 4, No 2, p 157-163, February 1970. 7 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Pollutant identification, *Organic compounds, *Oily water, *Water pollution sources, *Chromatography, Analytical techniques, Gas chromatography, Mathematical studies, Waste identification.
Identifiers: Pyrolysis.

For general characterization of industrial and municipal wastes in waterways, a direct pyrographic approach is based on high temperature pyrolysis of the water sample followed by immediate gas chromatographic separation of the resulting organic fragments. The amounts of these separated fragments are then measured with a hydrogen flame ionization detector. Through mathematical treatment utilizing all pyrographic peaks, the recorded pyrogram can be interpreted in terms of concentrations of the original organic components. Application of the technique to solutions containing a total of 100 ppm glycerol, DL-valine, and hexanoic acid in various ratios gave a standard deviation of 1.7 ppm. The sensitivity of the technique is sufficient to detect oil pollution levels of less than 10 ppm. (Knapp-USGS)
W70-09694

WATER QUALITY SURVEY OF THE POTOMAC ESTUARY - 1965-1966,
Federal Water Pollution Control Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Donald W. Lear, Jr., and James W. Marks.
Federal Water pollution Control Administration, Chesapeake Technical Support Lab, Data Report No 9, 1970. 71 p, 1 tab, 1 map.

Descriptors: *Water quality, *Sampling, *Data collections, Rivers, Water temperature, Turbidity, Suspended load, Dissolved oxygen, Biochemical oxygen demand, Organic matter, Nitrogen, Nitrates, Nitrites, Ammonia, Phosphorus, Chlorides, Chlorophyll.
Identifiers: Potomac River Estuary.

Water samples were collected in 1965 and 1966 to determine existing water quality of the Potomac estuary. Surface samples for chemical analysis were obtained by dipping a plastic bucket or large funnel into the river water with a minimum of agitation. Bottom samples were taken using a plastic Van Dorn sampler. Tabulated data include water temperature, turbidity, suspended solids, volatile solids, dissolved oxygen, biochemical oxygen demand, total carbon, total Kjeldahl nitrogen, organic nitrogen, ammonia, nitrate, nitrite, total phosphorus, inorganic phosphorus, chlorides, and chlorophyll a. (Knapp-USGS)
W70-09769

AN NMR STUDY OF THE PROTOLYSIS KINETICS OF SULFONAMIDES,
Georgia Univ., Athens. Dept. of Chemistry; and Georgia Univ., Athens. Dept. of Entomology.
J. F. Whidby, D. E. Leyden, C. M. Himel, and R. T. Mayer.
Georgia University Department of Entomology Research Support, 1970. 9 p, 4 fig. FWPCA Grant 16020-EAO.

Descriptors: *Biochemistry, *Tracers, *Organic compounds, *Nuclear magnetic resonance, *Sulfur compounds, Fluorescence, Ion exchange, Analytical techniques, Enzymes.
Identifiers: *Sulfonamides.

An NMR study was made of the protolysis of 5-dimethyl aminonaphthalene-1-sulfonic acid (DANS-acid) (1) and its N-methyl sulfonamide (11). Proton exchange studies on the 5-dimethyl amino group (5-DMA) of 1 and 11 were carried out in aqueous H_2SO_4 whereas proton exchange of the N-methyl sulfonamide moiety in 11 was carried out in aqueous 16.0 mole percent t-butanol. The pK of the 5-DMA moiety of 1 was determined to be 3.5 in 16% t-butanol by NMR and to be 4.52 + .03 in H_2O by spectrofluorescence measurements. (See also W70-06754, W70-09682 and W70-09683) (Knapp-USGS)
W70-09770

INTERMEDIATE PRODUCTS IN THE BACTERIAL DECOMPOSITION OF HEXADECANOL AND OCTADECANOL,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 05B.
W70-09829

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
G. E. Eden, and R. Briggs.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/13, p 191-206, 1967. 16 p, 9 fig, 4 tab, 6 ref.

Descriptors: *Path of pollutants, *Tracers, *Tracking techniques, Radioisotopes, Radioactivity techniques, Sewage treatment, Dispersion, Monitoring, Instrumentation, Sediment transport, Bed load, Suspended load.
Identifiers: Water pollution tracers.

During the last 10 yr radioisotopes have been used in many aspects of water-pollution research to provide information which could not have been otherwise obtained. Instrumentation for tracing dispersal of sewage in the sea is discussed. The tracer bromide Br-82 is added continuously to the flow of sewage entering the sea through a submerged outfall, or alternatively as a single dose to the sea at the site of a hypothetical outfall. The dispersal is mapped by scanning the area with gamma scintillation counters towed at predetermined depths, continuously monitored by echo sounders. Double-labelling techniques are described. By use of a non-adsorbable tracer (for example bromide Br-82, or cobalticyanide Co-60 or Co-58) to label the liquid phase and a highly adsorbed tracer (for example Au-198 or Ag-110) to label the solid phase, it is possible to study segregation effects. The technique was used to demonstrate the short-circuiting of solids in a sludge-digestion system and to compare relative retention periods of dissolved and suspended matter in a percolating filter. By simultaneous addition of a non-adsorbed tracer and the radioisotope under investigation it is possible to detect reversible adsorption on the bed of a stream or on the walls of a sewer. Measurements of the ratio of the activities due to the two tracers at a point downstream provides an extremely sensitive method of detecting reversible adsorption; this procedure might well be of use in selecting tracers for the determination of flow in streams by tracer methods. (See also W70-09868) (Knapp-USGS)
W70-09878

QUANTITATIVE ANALYSIS OF TOTAL CARBON DIOXIDE IN SEA WATER: A NEW EXTRACTION METHOD,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 07B.
W70-09892

THE NATURE OF AQUATIC POLLUTION,
State Univ. Coll., Fredonia, N.Y. Lake Erie Environmental Studies.
John A. Jones.
State University College, Fredonia, New York, Lake Erie Environmental Studies, Public Information Report No 2, 1970. 36 p, 23 fig.

Descriptors: *Water pollution sources, *Water pollution, *Water pollution effects, Pollutants, Coliforms, Toxicity, Nutrients, Suspended load, Nuclear wastes, Eutrophication, Sewage, Agriculture, Industrial wastes, Pesticides, Thermal pollution, Tertiary treatment, Detergents, Lake Erie, Bacteria, Viruses, Protozoa, Fungi, Worms, Radioisotopes, Salmonella, Shigella, Clostridium, Red tide, Mollusks, Trematodes, Chemicals, Copepods, Nematodes, Biochemical oxygen demand, DDT, Heavy metals, Nitrogen, Phosphorus, Powerplants, Cyanophyta, Wastes, Dredging.
Identifiers: Floating debris, Synergistic effects, Parasitic diseases, Classification of pollutants, Biological concentration, Petroleum industries, Parasitic worms, Biological pollutants, Chemical pollutants, Physical pollutants, Flow barriers, Shipping wastes, Boating wastes, Sublethal effects.

Water pollutants have been categorized as biological, chemical, and physical. The potential presence of most disease organisms may be detected by tests which determine the numbers of coliform bacteria. Chemical pollutants include substances exerting an oxygen demand, lethal and sublethal toxic substances, unpleasant non-toxic materials, and fertilizing nutrients. Presence and quantity of these pollutants are determined by chemical analyses, and their effects are generally readily evident in the environment. Physical pollutants include suspended sediments, floating debris, nuclear waste materials, and heat energy; these affect basic biological processes of organisms inhabiting natural waters or destroy the values of aquatic resources. Pollutants exert synergistic effects on aquatic organisms; thus, the presence of one pollutant increases the susceptibility of organisms to the other pollutants and environmental stresses. Chemical and physical pollutants appear to be the most problematical to the general environment; these include especially oxygen demand, eutrophication, toxic substances, and waste heat. The most hazardous pollution directly affecting the health of man are biological and chemical, including parasitic diseases and biologically accumulated toxic substances. Recovery and reuse of 'wastes' appears to be the only feasible solution to waste disposal in the long-term view. (Jones-Wisconsin)
W70-09906

TOXICITY EVALUATION OF A TECHNIQUE FOR INTRODUCING DIELDRIN INTO WATER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
George G. Chadwick, and Ulo Kiigemagi.
Journal Water Pollution Control Federation, Vol. 40, No. 1, 1968, p 76-82. 2 fig, 2 tab, 2 ref. PHS Grant No. E5-00040.

Descriptors: *Evaluation, Bioassay, *Toxicity, Dieldrin, *Laboratory equipment, Gas chromatography, Pesticide residues, Pesticide toxicity, Solubility, *Solvation, Lethal limit, Reliability.
Identifiers: *HEOD, Guppies.

A system has been developed and tested for introducing dieldrin or other sparingly soluble compounds directly into water for experimental studies. Particles of sand in sand-packed glass columns were coated either with dieldrin or HEOD, and water was passed through the columns. Samples of the effluent water from the columns were tested for HEOD content by gas chromatography and for acute toxicity by bioassay with young guppies. Results of analysis of effluent samples by gas chromatography showed that the HEOD concentration remained relatively constant over a period of several months. Bioassay showed that the toxicity of effluents from columns coated with technical dieldrin was initially many times greater than the toxicity that could have been due to the HEOD present. The results of acute toxicity tests and gas chromatographic analysis of water samples indicate that the toxicity of dieldrin in water that has been in contact with dieldrin may not be predictable on the basis of chemical analysis for HEOD alone. The ratios of the concentration of HEOD to concentrations of other unidentified toxic components of dieldrin present in dieldrin-contaminated water can be highly variable. (Sjolseth-Washington)
W70-09971

5B. Sources of Pollution

ADSORPTION OF VIRUSES ON MINERAL SURFACES,
Maine Univ., Orono. Water Resources Research Center.
Otis J. Sproul.
Available from NTIS as PB-193 795, $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, June 1970. 19 p, 5 tab, 6 fig, 2 ref. OWRR Project A-013-ME (3).

Descriptors: *Soil disposal fields, *Viruses, *Adsorption, *Bactiophage, Waste water treatment, Water pollution sources.
Identifiers: *Poliovirus, Minerals, Sillimonite, Enstatite, Wollastonite, Olivine, Kyanite, Microcline, Actinolite.

The specific aim was to determine the adsorption capacities of selected common minerals for viruses. Bench scale adsorption studies using T4 bacteriophage and the Type I poliovirus (Sabin Strain) and various silicate minerals have been carried out. The minerals used were sillimonite, enstatite, wollastonite, olivine, kyanite, microcline and actinolite. The size ranges for these minerals were restricted to between 1 and 10 microns in diameter. The adsorption of the bacteriophage T4 was related to the acidity of the silicate surfaces. A detailed study of the bacteriophage T4 and its adsorption on silicate minerals showed that the adsorption was related to the electrophoretic mobility. As the pH decreased the rate of virus adsorption increased at pH 4.3. There was a corresponding increase in slope in the mobility curve at this pH. At pH 3.3 the rate of virus adsorption decreased as the positive mobility declined. The adsorption of the bacteriophage T4 varied from about 50 to 99.5 percent for these minerals at pH values below 5. Slightly lower adsorption on the order of 50 to 80 percent was obtained in the adsorption of the poliovirus on the silicate minerals. These lower removals are partly attributed to the different type of virus which was used and also to the higher pH, A PH of 7.0, which was used in this work. A competitive effect on poliovirus adsorption was noted when extraneous organic materials were added either before or after the contact between the virus and the silicate material had occurred. Protein such as bovine albumin and egg albumin in concentrations of 1 and 1.5 mg/l were able to decrease the adsorption from 50 to 80 percent to as low as 12 to 20 percent. A domestic sewage secondary effluent decreased the adsorption of poliovirus by the same amount.
W70-09520

DISSOLVED OXYGEN RESOURCES AND WASTE ASSIMILATIVE CAPACITY OF THE LA GRANGE POOL, ILLINOIS RIVER,
Illinois State Water Survey, Urbana. Dept. of Registration and Education.
T. A. Butts, D. H. Schnepper, and R. L. Evans.
Report of Investigation 64, 1970. 28 p, 15 tab, 23 fig, 26 ref.

Descriptors: *Dissolved oxygen, *Nitrification, *Water quality control, Biochemical oxygen demand, Illinois, Oxygen sag, Reaeration, Rivers, Sanitary engineering, Time-of-travel, *Waste assimilative capacity, Water management, Water pollution sources, Water temperature.
Identifiers: Illinois River.

The La Grange navigation pool, a 77.4 mile reach of the Illinois River below Peoria, frequently experiences low dissolved oxygen concentrations which fall below 4.0 mg/l, the minimum standard. Weighted average DO concentrations as low as 1.65 mg/l, with a minimum DO of 0.9 mg/l, have been observed. Mathematical models were developed by statistical regression methods for predicting average and minimum pool DO concentrations. A variety of methodologies were investigated to determine the best procedure for defining the pool waste assimilative capacity; the Velz modification of the Black and Phelps procedure was selected. A quality control chart was designed to detect DO trends which deviate from expected patterns. The ability of the pool to assimilate organic wastes has been restricted because man has drastically altered the natural hydraulic and hydrologic characteristics of the river. A significant cause of DO depletion appears to be nitrification; this fact must be considered in future waste treatment requirements if significant water quality improvements are to be realized.
W70-09524

LEACHING FROM SIMULATED LANDFILLS,
Battelle Memorial Inst., Columbus, Ohio; and West Virginia Univ., Morgantown. Dept. of Civil Engineering.
Syed R. Qasim, and Jerry C. Burchinal.
Journal Water Pollution Control Federation, Vol 42, No 3, Part 1, p 371-379, March 1970. 9 p, 10 fig, 4 tab, 8 ref. USPHS Grant EF-40 (R1).

Descriptors: *Leaching, *Landfills, *Percolation, *Groundwater movement, Model studies, Laboratory tests, Path of pollutants, Water pollution sources, Self-purification, Biodegradation.
Identifiers: Simulated landfill.

Simulated landfills 3 ft in diam and 4 to 16 ft in height were filled with mixed municipal refuse. The cylinders were saturated with water and additional water added at two-week intervals. Percolated water was drained and analyzed on a regular schedule for chemical and bacterial quality. The study covered a maximum of 163 days. Concentration of extracted material increased initially but began to decrease after about four weeks. Another increase after eight weeks was evident. The concentration in the leachate of 18 organic and inorganic compounds over the period of the study is reported. pH showed a slight increase followed by a rapid decrease. Leach samples tend to undergo bacteriological and chemical self-purification. Deeper fills consume more water, before leaching occurs, take a longer time to decompose, and the bulk of the extracted material is distributed over a longer period. (Knapp-USGS)
W70-09548

CHEMICAL FALLOUT-CURRENT RESEARCH ON PERSISTENT PESTICIDES,
Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
For primary bibliographic entry see Field 05C.
W70-09559

CHLORINATED HYDROCARBONS IN MARINE ECOSYSTEMS,
California Univ., Berkeley. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W70-09560

PERSISTENCE OF PESTICIDE RESIDUES IN SOILS,
Agricultural Research Service, Beltsville, Md. Crops Research Div.
P. C. Kearney, R. G. Nash, and A. R. Isensee.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceedings Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 54-67, 1969. 14 p, 3 fig, 1 tab, 26 ref.

Descriptors: *Pesticide kinetics, *Pesticide residues, *Soil chemistry, *Biodegradation, Persistence, Translocation, Toxicity, Environmental effects, Leaching.
Identifiers: Pesticide-soil interactions.

Pesticide persistence in our environment is of current national interest. The effective life of pesticides in soils varies from a few weeks to several

years. Their persistence depends primarily on the structure and properties of the compound, and to a lesser degree on location and soil properties. Extremes in persistence are found with the insecticides. The highly toxic phosphates do not persist for extended periods of time in soils. In contrast, some of the chlorinated hydrocarbon insecticides may persist for four to five years under normal rates of application. Disappearance of most complex organic pesticides from soil follows a first-order reaction curve. Disappearance of simpler organic pesticides often exhibits a lag phase followed by rapid metabolism by soil microorganisms. Heavy metals and arsenic pesticides tend to accumulate at the application site. (See also W70-09559) (Knapp-USGS)
W70-09562

CONVERSION OF MERCURY COMPOUNDS,
Institutet for Vatten och Euftvardforskning, Stockholm (Sweden).
A. Jernelov.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceeding Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 68-74, 1969. 7 p, 12 ref.

Descriptors: *Path of pollutants, *Heavy metals, *Poisons, Biochemistry, Water pollution sources, Chemical wastes, Pesticides, Bottom sediments, Lakes, Water chemistry.
Identifiers: *Mercury, Methylmercury.

It is shown in Sweden that fish contain methylmercury in instances where the original discharge contains other types of mercury compounds. Mercury discharge in the form of metallic mercury, inorganic divalent mercury, phenylmercury and alkoxialkylmercury can all be converted in nature to methylmercury. (See also W70-09559) (Knapp-USGS)
W70-09563

MERCURY CONTAMINATION OF THE ENVIRONMENT IN SWEDEN,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
For primary bibliographic entry see Field 05C.
W70-09565

ENTRAINMENT IN DEFLECTED AXISYMMETRIC JETS AT VARIOUS ANGLES TO THE STREAM,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
J. L. Platten, and J. E. Keffer.
Technical publication series UT Mech E TP 6808, June 1968. 53 p, 9 fig, 1 tab, 15 ref.

Descriptors: *Jets, *Mathematical models, Porosity, Density, Water circulation, Shear, Vortices, Velocity, Turbulence, Stream flow, Simulation analysis, Winds, Uniform flow.
Identifiers: Entrainment.

A mathematical model for the round turbulent jet in a cross-wind is proposed. The analysis accounts for varied initial angle of injection to the uniform stream and incorporates a function which attempts to simulate the two entrainment processes suggested by observation of the real flow. The first of these is the growth of a turbulent field such as in ordinary jets and wakes, arising from the presence of a mean velocity difference. The second mechanism, peculiar to the deflected jet is the entrainment stemming from the presence of a vortex pair. Because of the shearing action of the cross-wind on the jet, a circulation is generated and fluid is swept into the wake regions of the flow. The model is applied to experimentally determined jet centre lines for a number of velocity ratios and initial angles of injection. The resulting entrainment parameters were found to be invariant within initial angles of plus or minus 15 deg to the normal jet and only moderately invariant up to plus or minus 45 deg. (Osborne-Vanderbilt)
W70-09603

COASTAL ENTRAPMENT IN LAKE HURON,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 02H.
W70-09606

THERMAL EFFECTS AND NUCLEAR POWER STATIONS IN THE U.S.A.,
Atomic Energy Commission, Washington, D.C.
R. E. Nakatani, D. Miller, and J. V. Tokar.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/30. 14 p, 1 tab, 21 ref. Preprint.

Descriptors: *Thermal pollution, *Nuclear power plants, *Cooling water, *Water temperature, Condensers, Design, Standards, Fish kill, Algae, Cooling towers, Density, Viscosity, Fish behavior, Fertility, Seasonal, Diffusivity.
Identifiers: *Waste heat, Sublethel effects, Mixing zones, Modeling.

Nuclear power plants in the U.S. were surveyed that are either operable, being built, or planned as of December 31, 1969. Over sixty percent of the plants used the once-through system where the condenser cooling water was taken from nearby rivers, lakes, estuaries, or the ocean and then usually returned to the same source. The average maximum temperature rise across the nuclear power plant condenser was approximately 10 degree C. General observations and recommendations based on statements describing the planning, design, and procedures for waste heat release and information obtained from personal plant visits include: (1) thermal quality standards are becoming increasingly stringent; (2) fish kills are rare and their severity limited; (3) studies of the short- and long-range movement and effects of heat should be undertaken; (4) the effort should be made to acquire knowledge of the sublethel effects of releasing heat; (5) alternate methods for releasing waste heat should and are being employed; (6) the need for stochastic and analytic models of plume behavior exists. (Osborne-Vanderbilt)
W70-09612

IMPROVED METHODS FOR PLANNING OF THERMAL DISCHARGES BEFORE SITE AQUISTION WITH A SPECIFIC CASE EXAMPLE ON THE COLUMBIA RIVER,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 04A.
W70-09613

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY,
AVCO Economic Systems Corp.
Jerry G. Cleveland, Ralph H. Ramsey, and Paul R. Walters.
Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 1-56, June 22-23, 1970. 6 fig, 14 tab, 4 ref. FWQA Contract 14-12-187.

Descriptors: *Storm runoff, *Water analysis, Pollution abatement, Drainage, Control, Water quality, Cities, Surface runoff, Precipitation, Analytical techniques, Land use.
Identifiers: Tulsa, Oklahoma.

An assessment of pollution in storm water as it relates to land activity is described. The central purpose of this effort was to design a method of analysis which would enable the city planner and engineer to assess the quality as well as quantity of storm water and to do so by looking at land activity, selected environmental factors, and precipitation. The scope of the project included a field assessment of the storm water pollution by obtaining samples of the water resulting from precipitation and surface runoff from selected areas in the Tulsa, Oklahoma metropolitan area; development of an analytical procedure for correlation of storm water pollution with selectively defined variables of land uses, environmental conditions, drainage characteristics, and precipitation; and development of a plan for implementing remedial measures necessary to abate or control sources of pollution in an urban area. Storm water runoff samples were collected from 15 'discrete' test areas. These samples were analyzed in terms of quality standards for BOD, COD, TOC, organic Kjeldahl nitrogen, soluble orthophosphate, chloride, pH, solids, total coliform, fecal coliform, and fecal streptococcus pollutants. Three approaches are recommended to abate and control the pollution load of storm runoff. These are: a reduction in total runoff, a reduction in runoff rates, and environmental policy. (See also W70-09558). (Marriott-Chicago)
W70-09615

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWERS BUCYRUS, OHIO,
Burgess and Niple Ltd., Columbus, Ohio.
Richard F. Noland, and Dale A. Decarlo.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 291-320, June 22-23, 1970. 16 fig, 3 tab. FWQA Contract 14-12-401.

Descriptors: *Overflow, *Storm drains, *Sewers, *Water pollution control, Engineering, Analytical techniques, Sampling, Urbanization, Ohio.
Identifiers: Combined sewer overflow, Lagoon system, Interceptor sewer, Bucyrus (Ohio), Sandusky River.

Results are described of a detailed engineering investigation and comprehensive technical study to evaluate the pollutional effects from combined sewer overflows on the Sandusky River at Bucyrus, Ohio which is tributary to Lake Erie. A year long detailed sampling and laboratory analysis program was conducted on the combined sewer overflows in which the overflows were measured and sampled at three locations comprising 64% of the City's sewered area and the river flow was measured and sampled above and below Bucyrus. The results of the study show that any 20-minute rainfall greater than 0.05 of an inch will produce an overflow. The combined sewers with overflow about 73 times each year discharging an estimated annual volume of 350 million gallons containing 350,000 pounds of BOD and 1,400,000 pounds of suspended solids. A method of controlling the pollution from combined sewer overflows is presented along with the degree of protection, advantages, disadvantages and estimate of cost. The method presented is an interceptor sewer and lagoon system. The most economical method of providing a high degree of protection to the Sandusky River is by collecting the combined sewer overflows with a large interceptor and using an aerated lagoon system to treat the waste lands from the overflows. (See also W70-09558). (Marriott-Chicago)
W70-09621

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
G. M. Hughes, R. A. Landon, and R. N. Farvolden.
Available from Bureau of Solid Waste Management, 5555 Ridge Ave, Cincinnati, Ohio, 45213. U. S. Department of Health, Education, and Welfare, Bureau of Solid Waste Management, 1969. 137 p, 24 illus, 9 tabs, 3 ref. No. DO 1 - UI - 00006.

Descriptors: *Hydrogeology, *Solid wastes, *Landfill, *Infiltration, *Water quality pollution, Recharge, Discharge, Groundwater, Surface waters, Aquifers, Flow rates, Leaching.
Identifiers: Northeastern Illinois.

This project describes the hydrogeologic environments in the vicinity of four existing landfill sites in the Chicago Metropolitan area, in order to determine the controls on the movement of the ground water and the solids dissolved in ground water. Groundwater recharge and discharge areas are

ined and the quantities of water moved and
s of movement through various materials and in
ious environments have been estimated. Infor-
tion from this preliminary study can be used by
ulatory agencies to help determine environ-
nts most suitable for near-surface disposal of
te insofar as contamination of groundwater and
face water is concerned. The problem of
undwater contamination by near-surface solid
te disposal is approached in terms of the
drogeologic environment. In some sites, water
t infiltrates the ground becomes part of a local
w system and is discharged into a nearby stream
swamp with little risk of contaminating an
ifer. In other sites this water becomes part of a
ional flow system and may enter productive
ifers with definite risk of contamination. The
finition of flow systems in homogeneous materi-
is relatively simple; however, the effects on this
w system of changes from one geologic material
another are more difficult to evaluate. This in-
mation is necessary if movement of refuse
achate from proposed disposal sites is to be pre-
ted. (Marriott-Chicago)
70-09637

OBLEM: HARBOR DEBRIS,
ffice of the Chief of Engineers (Army), Washing-
n, D.C. Civil Works Directorate.
gene B. Conner.
Water Spectrum, Issues, Choices, Actions, Vol.
No. 1, Spring 1970, p 9-13. 8 photo.

escriptors: *Aquatic drift, *Harbors, *On-site
ta collections, *Safety, *Navigation, Flotsam,
hannels, Channel improvement, Cost-benefit
alysis, Ordinances, Legislation, Urbanization,
and use, Public health, Governments, Planning,
nvironment, Water pollution.
dentifiers: *New York Harbor, *'Sweepers', *De-
ttering, *Harbor debris, Environmental quality,
ooperative governmental program.

e-littering in the Nation's 250 harbors and chan-
els is a staggering chore. In a survey of New
ork's harbor and tributaries, 2,000 abandoned
essels and over 2,300 shore structures and cluster
f floatable debris were found to be potential drift
ources. Sweeping boats removed some debris but
housands of accidents still occurred every year
ausing expensive damage and danger. Two
eneral approaches offered solutions to the drift
roblem: (1) to increase removal and disposal of
loating debris above present level, and (2) to
liminate the sources of drift by removal or repair
f derelict vessels and structures. Cost-benefit anal-
sis showed the latter to be best. Costs of removal
nd repair were estimated at $29 million and an-
ual cost of 1.5 million, while monetary benefits
would be over $10 million a year as well as other
benefits of reduction in fire hazards, air and water
ollution, hazards to life and health and improved
ppearance of the waterfront. A national survey
recommends an aggressive program to remove
ources of drift. Such a program offers an opportu-
nity for cooperation between Federal, State and
ocal governments to improve the quality of urban
nvironment. Successful implementation, requiring
enactment and enforcement of local ordinances to
regulate sources of drift, would greatly help in re-
ieving conditions of waterfront decay, ugliness and
blight, free waterside sites for functions having
positive effects on their neighborhood areas; and
bring about higher levels of usefulness and safety
for both commercial and recreational users of our
Nation's vital waterways and harbors. (Marriott-
Chicago)
W70-09640

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 05A.
W70-09674

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-09740

RADIONUCLIDE TRANSPORT AND RESPONSES TO ORGANIC STRESS IN A RESEARCH FLUME,
Texas Univ., Austin.
E. F. Gloyna, Y. A. Yousef, and T. J. Padden.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 13 p, 7 fig, 4 tab, 13 ref.

Descriptors: *Flumes, *Streams, *Mathematical model, *Plants, *Sediments, Ecology, Toxicity, Water pollution sources, *Ecosystems.
Identifiers: Organic stress, *Radionuclides, *Activity systems.

Small ecosystems established in aquaria, control reservoirs, and large flumes are useful tools for simulating stream processes and evaluating the complex factors which interact with various pollutional stresses. By simulating the physicochemical characteristics of an aquatic system the flume can be used to determine the interrelationships between atmospheric reaeration, photosynthesis, respiration, organic load, biomass, and sediments. Measurements of responsed of the aquatic system to conventional pollutional stresses and radionuclide behavior can and has been shown to aid in the development and verification for prediction models. The principal mechanism of radionuclide transport is hydrodynamic, however, other influences of the rate of movement are: (1) the amount and type of suspended matter, (2) chemical character of the bottom sediment and aqueous system and (3) surface and concentration of radionuclide of both the dead sediments and biomass. The organic suspension when compared on a unit weight basis tended to sorb 103Ru in much larger amounts than inorganic suspensions. Sorption of 137Cs by clay suspensions was a function of the amount and type of clay in suspension The amount of radionuclide retained by dead sediment is a function of organic pollution. Side-wall temperature must be controlled carefully in small-scale systems to prevent convection currents, particularily if controlled by atmospheric aeration is important. (Hancuff-Texas)
W70-09743

A MATHEMATICAL MODEL OF SELF-PURIFICATION PROCESS IN A CANALIZED HIGHLY POLLUTED RIVER,
Water Economics Research Inst., Wroclaw (Poland).
For primary bibliographic entry see Field 05D.
W70-09765

THE PERSISTENCE OF PESTICIDES IN IMPOUNDED WATERS,
Kentucky Water Resources Inst., Lexington.
Robert A. Lauderdale.
Available from NTIS as PB-194 056, $3.00 in paper copy, $0.65 in microfiche. Kentucky University Water Resources Institute Research Report No 17, 1969. 39 p, 8 fig, 5 tab, 8 ref. OWRR Project No A-002-Ky (4).

Descriptors: *Water pollution effects, *Pesticides, Residues, *Pesticide kinetics, *Persistence, Evaporation, Biodegradation, Adsorption, Algae, Clays, Aldrin, Dieldrin, DDT, Aeration, Silts.
Identifiers: Chlordane.

The persistence of the insecticides aldrin, dieldrin, chlordane, and DDT in water were measured. A small area was sprayed with these compounds, and the insecticides were collected in the runoff water from the area. Laboratory experiments were performed to determine the effectiveness of aeration, adsorption on silt, and adsorption on algae in removing the pesticides from water. All of the pesticides were found in samples of water collected for the full period of the tests. The amounts which were found in a small pond into which the surface water drained was consistently less than that found in the surface runoff water itself. The reduced concentrations in the pond water were apparently the result of a combination of sedimentation, adsorption on algae or silt, or volatilization of the insecticide from the water into the atmosphere. In general, the efficiency of removal of insecticide from water by any one of these processes appears to be low. However, because of the large ratio of absorbant to insecticide, the overall removal is substantial. (Knapp-USGS)
W70-09768

WATER QUALITY SURVEY OF THE POTOMAC ESTUARY - 1965-1966,
Federal Water Pollution Control Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05A.
W70-09769

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.

Supplementary Report, June 1970. 56 p, 52 fig. Repair Work in Conjunction with Community Renewal Program Project No. La-R-6 (CR).

Descriptors: *Repairing, *Sewers, *Leakage, *Inflow, *Water pollution control, *Pollution abatement, *Drainage systems, *Storm drains, *Drainage systems, *Municipal wastes, *Sewerage, *Pumping plants, *Disinfection, *Chlorination, *Water quality control, Waste water treatment, Path of pollutants, Lakes, Infiltration.
Identifiers: *Sewer repairs, *Leakage repairs, *Pipe repairs, *Sewer repair costs, *Storm water pollution, *Sewer inspection, *Sewer leakage, *House sewers, Lake Pontchartrain, New Orleans, Televised inspections.

The results were evaluated of sewer repairs that were made by the New Orleans Sewerage and Water Board to correct major leaks and defects found using television equipment. Field inspection work was conducted in 1969 to determine how and to what extent the storm waters discharged to Lake Pontchartrain are being polluted by domestic sewage. The results were published in a basic report, having the same title as this supplementary report, dated June 1970. Upon completion of the repairs of 47 major defects, exfiltration tests were made on the repaired lines. The results indicated excessive leakage still existing. There must be considerable leakage from unrepaired house sewer connections. If all house connections 20 years or older are repaired, the costs would be over $30 million. Other actions planned or underway include: relining existing sewer pipes with flexible thin plastic pipe; construction of a new sewer line to eliminate discharges of contaminated sewage from overloaded pumping stations; and installation of disinfection facilities at sewage pumping stations, using sodium hypochlorite. A unique plant for preparing the chemical was constructed. Television photographs of pipe leakage and exfiltration data are included. (Poertner)
W70-09801

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.

Final Report, June 1970. 117 p, 29 fig, 49 tab, 14 ref. Community Renewal Extension Project No. La-R-6 (CR).

Descriptors: *Pollutant identification, *Water pollution, *Path of pollutants, *Water pollution control, *Pollution abatement, *Leakage, *Storm drains, *Drainage systems, *Sewers, *Municipal wastes, *Inflow, *Sewerage, *On-site investigations, *Lakes, *Water quality control, Inspection,

On-site tests, Repairing, Infiltration, Dye releases, Cracking, Pumping plants, Design standards, Installation.
Identifiers: *Storm water pollution, *Sewer leakage, *Cross flow, *Televised inspections, *House sewers, *Cross connections, *Sewer inspection, Lake Pontchartrain, New Orleans, Infiltration tests.

The findings are presented of field inspections of the operating condition of sanitary sewers and storm sewers in New Orleans to determine how, and to what extent, the storm waters discharged to Lake Pontchartrain are being polluted with domestic sewage. Television cameras were pulled through sewers to view leakage into sewer pipes at open joints, fractures and house connections. Leakage between 8 inch diameter sanitary sewers and storm sewers were first studied carefully by means of conducting exfiltration tests in selected city blocks where both sanitary and storm sewers are present. It was found that the major source of storm water pollution came from accidental cross flows between sanitary sewer house connections and storm sewers at points of crossing, particularly where house sewers cross beneath storm sewers. These cross flows resulted from broken or cracked pipes and pipe joints in both systems. The fractures are attributed to the weight of the overlying storm sewer on the house connections beneath. Soil settlements caused the storm sewers to settle until they exerted forces on these pipes. Recommendations are given for the design and installation of sanitary sewers, house connections, and storm sewers. Explanation of field inspection procedures and television inspection data are included. (Poertner)
W70-09802

INTERMEDIATE PRODUCTS IN THE BACTERIAL DECOMPOSITION OF HEXADECANOL AND OCTADECANOL,
Texas A and M Univ., College Station.
W. D. Langley.
Available from the NTIS as PB-194 237, $3.00 in paper copy, $0.65 in microfiche. Texas A and M University Water Resources Institute Technical Report TR-29, June 1970. 59 p, 13 fig, 4 tab, 16 ref. OWRR Project No A-012-Tex (1).

Descriptors: *Biodegradation, *Hexadecanol, *Octadecanol, *Monomolecular films, Alcohols, Evaporation control, Analytical techniques, Sampling, Bacteria, Aquatic microbiology, Chromatography.
Identifiers: Gas-liquid chromatography.

The biodegradation of the monolayer film-forming chemicals hexadecanol and octadecanol were related to water quality factors. Detection, identification, and behavior of any intermediate or end product compounds formed as a result of the biological transformation of the hexadecanol or octadecanol were investigated. The behavior of long chain fatty alcohols was correlated with published analyses of lower molecular weight alcohols. Straight chain primary alcohols appear to represent a competitive substrate system with respect to microbial selectivity. In the presence of branched chain primary alcohols, the straight chain forms appear to constitute a preferred substrate system. The branched chain primary alcohols are biodegradable; their rate of degradation is however, retarded. (Knapp-USGS)
W70-09829

POWER LAW SOLUTIONS FOR VERTICAL PLUMES,
California Univ., Irvine. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09840

SIGNIFICANCE OF DDT RESIDUES FROM THE ESTUARY NEAR PENSACOLA, FLA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla., Center for Estuarine and Menhaden Research, Breeze, Fla.
David J. Hansen, and Alfred J. Wilson, Jr.
Pesticides Monitoring Journal, Vol 4, No 2, p 51-56, September 1970. 6 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Pesticide residues, *Fish, *Florida, *DDT, *Estuaries, Path of pollutants, Toxicity, Persistence, Water pollution sources.
Identifiers: Pensacola Bay (Fla).

Pesticide residues in fishes from the estuary near Pensacola, Fla., monitored from April 1964 to November 1965, are compared with residues in fishes exposed to DDT in the laboratory. DDT in fish exposed to 0.1 ppb p,p'-DDT 5 weeks failed to increase after the second week, when maximum concentrations reached 38,000 times that in the test water. Loss of DDT from these fish was slow, 78%-87% in 8 weeks. The amounts of DDD or DDE in fish did not increase either during or after exposure. Residues in fish from the estuary rarely exceeded 0.1 ppm except in those collected from the lower estuary in the summer and fall when the amount of DDT and its metabolites reached 1.3 ppm. Fish from the lower estuary had more DDT and less DDD and DDE than fish from the upper estuary. The DDT content in lower estuarine fish increased in July, August, and September. One source of DDT was a county-sponsored spray program centered in the lower estuary in July and August. (Knapp-USGS)
W70-09847

DIFFUSIVE PROPERTIES OF INTERFACIAL LAYERS,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.
Anders Sjoberg.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D8, p 71-78, 1967. 8 p, 5 fig, 11 ref.

Descriptors: *Stratified flow, *Density stratification, *Thermal stratification, *Mixing, *Path of pollutants, Dispersion, Diffusion, Turbulence, Turbulent flow, Fjords, Interfaces, Shear.
Identifiers: Sweden.

The Swedish coastal waters - particularly on the West Coast - have a pronounced density stratification. It is possible to design a submarine outfall in such a way that a submerged sewage field is established. It is necessary to know how the vertical stability of such a submerged sewage field is affected by surface currents, wind generated waves, and turbulence at the bottom. The few experimental investigations of stratified flow which a theory can be based on are reviewed and as much information as possible is extracted from these investigations. Experimental data are presented in a manner suitable to the description of turbulent transfer of matter and momentum across interfaces. (Knapp-USGS)
W70-09867

BIOLOGICAL IMPLICATIONS OF A MARINE RELEASE OF Sr-90,
Naval Radiological Defense Lab., San Francisco, Calif. Biophysics Branch.
Burton E. Vaughan, and John A. Strand.
Health Physics, Vol 18, p 25-41, 1970. 4 fig, 4 tab, 65 ref.

Descriptors: *Strontium radioisotopes, *Sea water, *Biota, Radioactivity, Mathematical models, Water pollution sources, Coasts, Kinetics, Fish, Food webs, Economic impact, Industries, Benthos, Monitoring, Carnivores, Scavengers, California, Phytoplankton, Zooplankton, Detritus, Bacteria, Herrings, Crabs, Clams, Oysters, Shrimp, Fisheries, Crustaceans, Mollusks, Proteins, Rhodophyta, Phaeophyta, Gamma rays, Radioisotopes, Marine animals, Adsorption, Model studies.
Identifiers: *Radio contamination, Operation Swordfish, Pelagic organisms, Sessile organisms, Migratory organisms, Migratory interception, Filter feeders, Radioactive pool size, Biolog monitoring, Kelp, Seaweeds, Gelidium cartilag um, Macrocystis pyrifera, Alginic acid, Agar, copolysaccharidic envelope, Ulva.

For a situation represented by instantane release of strontium-90-oxide in the ocean, a mo of biotic radiocontamination has been devi based more realistically on known characteris of coastal marine organisms. In this contamina model radioactivity concentration in soft tissue migratory fish has been determined by p radioactivity using a modified Carter-Okubo di sion model, uptake and concentration kinetics, migratory interception as a function of pool s Reasonably good validation was provided by inf mation available from Operation Swordfish, differences in Operation Swordfish release an hypothetical release of strontium-90-oxide w examined. For 750 curies of strontium-90-ox released, probably contamination of economic important pelagic fish would be accordingly than consequent on a water concentration ma tained at 1 million parts/cubic centimeters. Cert limitations as to generalizing this model discussed. The problems arising chiefly conce behavior of sedentary organisms, and biological take during very protracted release conditions. these two cases present state-of-the-art does permit adequate assessment of radiocontamin tion. The localized release considered here can constitute a potential hazard to man if norm radiation protective actions are implemente (Jones-Wisconsin)
W70-09903

PROPOSED PLANS FOR SEWAG DISCHARGE FROM THE GOTHENBERG R GION, SWEDEN,
Goteborg Water and Sewage Authority (Sweden).
For primary bibliographic entry see Field 05D.
W70-09942

TRANSFORMATION OF RIVER WATER A THE MOUTH OF A RIVER AND SOM CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02K.
W70-09946

APPLIED RESEARCH ON MARINE SEWAG DISPOSAL FROM THE GOTHENBURG RE GION, SWEDEN,
Stockholm Univ. (Sweden). Internationa Meteorological Inst.
L. Arnborg, and E. Eriksson.
Fifth International Water Pollution Research Con ference, San Francisco, July 26-August 1, 197 Preprint. 7 p, 7 fig.

Descriptors: *Research and development, *Wate pollution, Phosphorus, Thermal stratification, Cur rents (Water), Algae, Lakes, Rivers, Sewag disposal, Sewage treatment, Waste water treat ment.
Identifiers: *Marine disposal, *Gothenbur Sweden.

The city of Gothenburg at the west coast of Swede plans to construct a system of intercepting sewer and rock tunnels by which all the sewage from the city can be conveyed to a treatment plant. Afte biological treatment, the sewage can be discharge either into the river mouth or into the sea outside nearby archipelago. In order to compare the dif ferent outfall sites, an investigation of the area wa undertaken from the mouth of the river, Gota Alv through the archipelago into the open sea. The mean values and standard deviations of the vertica distribution of temperature, salinity and density during summer and winter in the area outside the archipelago are presented graphically. Large varia tions of current patterns take place due to tides winds, and variations in the atmospheric pressure The main directions of the currents are North and South with the resultant to the North. A figure is

esented showing the frequencies spectrum densi-
. The study of the use of a diffuser system for the
spersal of treated sewage resulted in the following
esign and conclusions: The area of release is 3 km
est of the archipelago. The diffuser portholes are
1 m in diameter and located 30 to 35 m below the
rface. The initial velocity through the portholes
ill be 2.5 meters/second. With this arrangement
d the existing vertical density stratification the
um will rise to a level of 14 to 20 meters below
e surface. (Hancuff-Texas)
70-09947

NTERNATIONAL SHOE CO V HEATWOLE
RIVATE CAUSE OF ACTION FOR POLLU-
ION).
or primary bibliographic entry see Field 06E.
70-09983

C. Effects of Pollution

HEMICAL FALLOUT-CURRENT RESEARCH
N PERSISTENT PESTICIDES,
ochester Univ., N.Y. Dept. of Radiation Biology
nd Biophysics.
Morton W. Miller, and George G. Berg.
pringfield, Illinois, Charles C. Thomas, Publisher,
969. 531 p.

escriptors: *Pesticide toxicity, *Persistence, *En-
ironmental effects, *Path of pollutants, Pesticide
inetics, Water pollution sources , Chlorinated
ydrocarbon pesticides, DDT, Dieldrin, Water pol-
ution effects, Ecology, Birds, Fish, Balance of na-
ure, Biology, Food chains, Lakes, Oceans, Estua-
ies, Productivity, Heavy metals, Poisons.
dentifiers: Pesticide effects (Ecological), Mercury.

A symposium was held on the topic of the effects of
ersistent pesticides on ecological systems, includ-
ng effects on man. Five sections are arranged in a
equence that follows pesticides from their entry
nto the ecological systems to their ultimate effects
n the human population. The ecological fate of
esticides is narrowed from ecosystems to single
opulations and their relationships to economic,
olitical-administrative, and agro-ecological social
ubsystems. Examples are given of the way in which
he interplay of economics and politics makes
cology a more complicated study to government
nd industrial scientists than to university-based
ecologist. The mechanism of damage in individuals
is examined. Protecting human populations from
damage caused by these persistent pesticides is
discussed by the editors. (See also W70-09560 thru
W70-09565) (Knapp-USGS)
W70-09559

CONVERSION OF MERCURY COMPOUNDS,
Institutet for Vatten och Euftvardforskning,
Stockholm (Sweden).
For primary bibliographic entry see Field 05B.
W70-09563

THE SIGNIFICANCE OF DDT RESIDUES IN
ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla.
Biological Lab.
For primary bibliographic entry see Field 05A.
W70-09564

MERCURY CONTAMINATION OF THE EN-
VIRONMENT IN SWEDEN,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
A. G. Johnels, and T. Westermark.
In: Chemical Fallout-Current Research on Per-
sistent Pesticides, Proceedings Publication of
Rochester Univ Conferences on Toxicity: Spring-
field, Ill, Charles C. Thomas Publisher, p 221-241,
1969. 21 p, 8 fig, 6 tab, 21 ref.

Descriptors: *Heavy metals, *Poisons, *Pesticide residues, *Water pollution sources, *Persistence, Biochemistry, Path of pollutants, Chemical wastes, Aquatic environment, Environmental effects, Toxicity, Water pollution effects, Fish, Birds.
Identifiers: Mercury.

Mercury and mercury compounds have a wide use in agriculture and industry, and an increase in natural levels of mercury content has been recorded. By means of activation analysis, the mercury content in feathers of eleven Swedish terrestrial bird species was studied. The material was derived from museum collections and from living or freshly killed birds; it covers a period of more than 100 years. These studies reveal nearly constant mercury levels from the middle of the previous century until 1940. After that, a well-documented increase in mercury concentration occurs, amounting to at least ten to twenty times the previous level. In 1940 alkylmercury compounds began to be used as seed dressings. The mercury content in axial musculature of pike (Esox lucius) has been used for estimating the level of mercury in the aquatic environment. Two fish-eating bird species show a gradual increase in mercury content since the previous century. (See also W70-09559) (Knapp-USGS)
W70-09565

POSSIBILITIES FOR BENEFICIAL USES OF HEATED WATER DISCHARGES INTO COOLING RESERVOIRS,
Missouri Univ., Columbia. Dept. of Zoology.
Robert S. Campbell, Arthur Witt, Jr., and James R. Whitley.
Fifth Annual Water Resources Research Conference, Feb. 3-4, 1970, Washington, D.C., U.S. Dept. of Interior, Office of Water Resources Research, June 1970. p 57-64, 27 ref.

Descriptors: *Heated water, *Beneficial use, *Cooling water, *Fisheries, Water quality, Fish attractants, Fish harvest, Plankton, Benthic fauna, Algae, Ecology, Missouri.
Identifiers: Cooling reservoir, Artificial reservoir, Montrose Lake, Thomas Lake.

Montrose Lake and Thomas Lake in Missouri were studied. Both were artificial cooling reservoirs. Studies included water quality, primary production of algae, plankton and bottom fauna and fish. Impact of heated water upon the ecology of a reservoir will be lessened as the volume of the reservoir is increased. Employment of a long cooling canal results in loss of heat to the atmosphere prior to discharge into the reservoir. Under the conditions existing in Thomas Hill Reservoir, no lethal effects from heated water inflow was observed. Beneficial effects which may be derived from controlled discharge of heated water are: (a) Migration of fishes may result in a buildup of fish densities. (b) The increased density of fishes may provide an extended harvest into the winter period. (c) Continued growth of game fishes may occur during the winter period. (d) An increased production of commercially raised fish may be possible. (e) The location of the power plant might be planned to provide optimal conditions for fish harvest and for use of heated water effluent in hatchery and rearing pools. (Hsieh-Vanderbilt)
W70-09596

BENEFICIAL USE OF WASTE HEAT IN AGRICULTURE,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 03C.
W70-09597

CHANGING CLIMATE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 02A.
W70-09599

PLUME EFFECTS OF NATURAL DRAFT HYPERBOLIC COOLING TOWERS,
Gilbert Associates, Inc., Reading, Pa.; and Metropolitan Edison Co., Reading, Pa.
Robert F. Visbisky, George F. Bierman, and Carroll H. Bitting.
Gilbert Associates, Inc. Interim Report. 11 p, 4 fig, 1 ref.

Descriptors: *Cooling towers, *Fog, *Aerial photography, *Statistical models, Meteorological data, Weather patterns, Micrometeorology, Heat transfer, Momemtum transfer, Wind velocity, Temperature, Humidity, Computer models.
Identifiers: *Visibility, Plume.

Preliminary investigations of the effects of cooling tower plumes were performed by various methods such as photography, mathematical modeling and meteorological measurements. The results of the studies to date indicate that cooling tower plumes will, at times, contribute to local cloud formations in varying degrees, depending on atmospheric conditions. The degree of this contribution does not appear to have a significant effect upon the operation of an airport approximately 2 1/4 miles from the plant site. The airport is not located in the predominant downwind direction. Temperature and relative humidity measurements by aircraft at low altitudes are presently being analyzed. The correlation of this information with data already accumulated by other means will further refine the predicted plume characteristics for this particular location. Generally speaking, investigative work has only begun and much more will have to be accomplished. (Hsieh-Vanderbilt)
W70-09604

EFFECTS OF HEATED DISCHARGES ON THE AQUATIC ENVIRONMENT THE TVA EXPERIENCE,
Tennessee Valley Authority, Chattanooga.
M. A. Churchill, and T. A. Wajtalik.
Proceedings, American Power Conference, 1969, Vol 31. 9 p, 9 fig, 1 tab. Also (in slightly different version) in Nuclear News, Sept. 1969, p 80-86. 6 fig, 6 tab.

Descriptors: *Thermal pollution, *Heated water, *Thermal powerplants, *Nuclear powerplants, *Water temperature, *Aquatic life, Tennessee Valley Authority Project, Isotherms, Fish, Periphyton, Benthic fauna, Zooplankton.
Identifiers: *Temperature distribution.

Since 1955, TVA has been observing the distribution in streams and reservoirs of heated waters discharged from TVA's thermal-electric powerplants. Detailed biological surveys have been made at all of TVA's steam plants except the Shawnee located on the Ohio River. No significant effects on aquatic life have been found except at the Paradise plant on the small Green River in Kentucky. Here, observed effects on fish-food organisms indicated more control of maximum stream temperatures to be desirable. Cooling towers have been built here. At the two nuclear power plants now under construction, multiport diffusers on the bottom of the old river channel in the receiving reservoirs will provide diffusion and rapd mixing. Stream temperatures will not be allowed to increase more than 10F, nor to exceed 93 F, at any time. (Hsieh-Vanderbilt)
W70-09605

THE THERMAL ENRICHMENT OF AQUATIC HABITATS,
Central Electricity Generating Board, Berkeley (England).
R. SA. Beauchamp, F. F. Ross, and J. W. Whitehouse.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 13 ref.

Descriptors: *Heated water, *Beneficial use, *Water temperature, *Heat resistance, Fish, Salmonids, Powerplants, Bottom sediments, Oxygen sag, Plankton, Benthos, Ecology.

This paper is concerned with power station cooling water discharges into rivers, lakes, estuaries and marine waters, and their effects on the ecology of such waters. Eighteen years' work by the biologists of the C.E.G.B. and its predecessors in title are summarized. The use of river water usually improves its quality and capacity to support a variety of aquatic life. In freshwater there would appear to be few problems, provided the temperature does not exceed the appropriate limit for the fish concerned, with no limitation on temperature-rise. It has to be established whether it is justifiable to install expensive engineering works to restrict maximum temperatures to less than 30C in marine waters. It will be economically advantageous to discharge a small quantity of cooling water per kwh at a higher temperature than has been the practice hitherto. If this discharged warm water is spread out over the surface of the estuary it will cool rapidly, no harm to fish will result, and the benthos will not be affected. (Hsieh-Vanderbilt)
W70-09608

COOLING WATER OUTLET IN A STRATIFIED RECIPIENT,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).
I. Larsen.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 4 p, 1 fig, 2 ref.

Descriptors: *Cooling water, *Density stratification, *Thermal stratification, *Intakes, *Outlets, Nuclear powerplants, Mixing, Convection, Turbulence, Salinity, Winds.
Identifiers: *Selected withdrawal.

An outlet of cooling water from a nuclear power plant into a receiving water with a marked stratification due to differences in salinity is discussed. Due to this stratification, a low temperature of the cooling water at the bottom intake can be secured and recirculation of heat can be avoided. The spreading of the heated water is affected by the stratification. (Hsieh-Vanderbilt)
W70-09609

THE IMPACT OF ENVIRONMENTAL RADIATION AND DISCHARGE HEAT FROM NUCLEAR POWER PLANTS,
Westinghouse Electric Corp., Pittsburgh, Pa.
J. H. Wright, J. B. F. Champlin, and O. H. Davis.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/20. 21 p, 6 fig, 1 tab, 6 ref. Preprint.

Descriptors: *Nuclear power plants, *Radiation, *Cooling water, *Heated water, Fish, Radioisotopes, Potable water, Cyanophyta, Chlorophyta, Oxygen sag, Aquatic environment, Biochemical oxygen demand, Water temperature, Nutrient requirements, Metabolism, Fishkill, Shellfish.
Identifiers: *Federal Radiation Council.

The exposure to the general public from maximum AEC emissions is between 1 and 5 mrem/year. A large nuclear reactor would have to operate with all of the fuel in a failed and leaking condition in order to develop the maximum isotope release allowed. More than 1000 large nuclear plants could be operating on the same site at the level of 1% failed fuel without exceeding the FRC recommended exposure to the nearby general public. The average nuclear powerplant cooling ponds yield an exposure of only .12 mrems per year to a person who obtains his average fish diet from the small pond plus all of his drinking water. Heat discharge from nuclear power plants has also caused negligible change in the aquatic ecosystem. However, a river already high in biological oxygen demand from raw sewage and industrial wastes may develop an oxygen sag, below the life support level is subjected to the further stress of heated discharges. A shift in temperature of 8 deg C is all that is required to alter optimum production temperature from green to blue-green algae, if nutrient levels will also support the bloom. (Osborne-Vanderbilt)
W70-09610

DOES INDUSTRIAL COLEFACTION JEOPARDIZE THE ECOSYSTEM OF A LONG TIDAL RIVER,
Connecticut Yankee Atomic Power Co., Haddam.
Daniel Merriman.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/31. 33 p, 5 fig, 1 tab, 45 ref. Preprint.

Descriptors: *Nuclear power plants, Effluents, Water temperature, Benthic fauna, Fish kill, Salmon, Cost-benefit ratio, Ecosystem, Smolt, Catfish, River flow, Hydrologic data.
Identifiers: *Colefaction, Connecticut River, Shad, Marasmus.

The Connecticut Yankee Atomic Power Company discharges its effluent into the Connecticut River at a temperature of 12.4 degree C above that at intake and at a rate of 1400 m cu/min. To determine the effects of the effluent, the preoperative phase while the plant was being built (1965-1967) was compared with the operative phase (1968-present). Included in this comparison were present and past studies of physical and chemical characteristics of the lower reaches of the river, of the benthic fauna, of the population dynamics of the resident fish fauna, and of the fish kills. Salmon restoration in the river would not be affected by electric generating plants. River water was being effectively used for the production of electricity with minimum harmful environmental disruption. The short term observation failed to take into account subtle, long-term effects which were not predictable at that time. By 1971-1972, much more information will be available to determine the success of shad emmigrating past the Connecticut Yankee effluent, but presently, the harm is outweighed by the benefits. Forty-five references are included. (Osborne-Vanderbilt)
W70-09611

THERMAL EFFECTS AND NUCLEAR POWER STATIONS IN THE U.S.A.,
Atomic Energy Commission, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-09612

THERMAL EFFECTS STUDIES IN NEW YORK STATE,
Stoller (S. M.) Associates, New York; and Niagara Mohawk Power Corp., Buffalo, N.Y.
Thomas W. Philbin, and Howard D. Phillipp.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/32. 13 p, 3 tab, 10 ref. Preprint.

Descriptors: *Power plants, *Thermal pollution, *Thermal stratification, Hydraulic models, Fish, Algae, Fathometers, Benthic fauna, Benthic flora, Lake Ontario, Hudson River, Standards, Surface waters, Epilimnion, Intake structures, Discharge (Water), Water temperature.
Identifiers: Lake Cayuga, Cladophora, Ecological studies.

Several thermal effects studies have been and are presently underway to determine what the effects of thermal discharges are on the water environment of New York State. At present, the results are incomplete; but they do yield enough information to allow some initial conclusions. On Lake Ontario, the Ginna and Nine Mile Point studies showed that fish tended to gather around both intake and discharge structures, slightly altering the local fish and benthic distributions. On Lake Cayuga, the Bell Nuclear Station has been postponed with no immediate plans for resumption. Physical effects studies on the lake, if the Bell Station plant were operating, have yielded a probable 0.7 degree F rise in the average surface temperature along with an eight to ten day longer stratification period. Moreover, in October, water could possibly be drawn from the epilimnion, increasing discharged water another 5 degree F. However, if New Y State discharge standards are adhered to, no a effects are anticipated even close to the outfall. the Hudson River, on the other hand, increa water temperatures as high as 91 degree F do appear to influence the abundance of (Osborne-Vanderbilt)
W70-09614

THE RELATIVE SIGNIFICANCE PHOSPHORUS AND NITROGEN AS ALG NUTRIENTS,
North Carolina Water Resources Research In Raleigh.
Charles M. Weiss.
Available from the NTIS as PB-194 054, $3.0 paper copy, $0.65 in microfiche. Report No. Water Resources Research Institute of The Univ sity of North Carolina, June 1970. 54 p, 27 fig ref, 2 append. OWRR Project B-003-NC (2).

Descriptors: Eutrophication, *Algal bloo *Nutrients, *Phosphorus, *Nitrogen, *No Carolina.
Identifiers: Nutrient interchange, Haw River, N Hope River.

By the examination of the interaction betwe nitrogen and phosphorus species relative to al growth in several fresh water environments of c fering trophic state, it has been possible to establ the relative significance of these elements as al nutrients. The algal assay was carried out usi membrane filtered samples derived from a series oxidation ponds receiving secondary effluent fr a trickling filter plant and from samples deriv from sampling points on the New Hope and H Rivers. The latter represented a series of changi river qualities with particular respect to the oxid tion states of nitrogen and phosphorus. The alg assay used pure cultures of five species; Eugle rostifera, Chlamydomonas reinhardtii, Pandori morum, Scenedusmus quadricauda, and Chlore ellipsoidea. Each of these species has be described as normally associated with pollut waters. The results of both chemical and biologic assay examined through multiple regression anal sis of the independent variable involved in the alg assay as well as a quadratic analysis of covarian of NH3-N, NO3N and PO4-P established the rel tive significance of the nitrogen and phosphor species in water containing high concentrations these elements, concentrations normally found discharges from biological waste treatment plan and following dilution in receiving streams. Und these circumstances it has been shown that th quantity of nitrogen rather than that of phosphor determines the biomass of algae that might be e pected to grow. This response holds true for th several species of algal that were used. It woul thus appear that the question of algal nutrien takes on a somewhat more formidable dimensio due to the considerably greater difficulty in remo ing in significant amounts the nitrogen that is no mally found in municipal waste waters.
W70-09669

VARABILITY OF WINTERKILL SURVIVAL I FISHES,
Wisconsin Univ., Madison. Water Resource Center.
Ronald J. Berg, and John J. Magnuson.
Available from the NTIS as PB-194 031, $3.00 i paper copy, $0.65 in microfiche. Final Report University of Wisconsin, Water Resources Cente 1970. 40 p, 4 tab, 2 fig, 25 ref, append. OWRR A 024-WISC (1).

Descriptors: *Dissolved oxygen, *Winterkilling Yellow perch, Wisconsin.
Identifiers: Grassy Lake, Trout Lake.

Dissolved oxygen concentrations lethal to yello perch from Grassy Lake, which has a history o winterkill, were compared with concentration lethal to yellow perch from Trout Lake, which doe not winterkill, to determine if yellow perch fro

rassy Lake were more tolerant. Closed system spirometers (57kliter aquaria containing 24 liters f water with mineral oil) were used. Dissolved oxgen was determined by the Alsterberg modificaion of the Winkler method. Winter experiments ken directly from both lakes and with yellow erch which were taken from both lakes and then cclimatized to aerated holding ponds. Mean oxgen concentrations lethal to ten fish (8 to 32 g) ken directly from Grassy Lake which were acclimatized to aerated ponds were 0.15 mg and 0.35 g/liter, respectively. Mean oxygen concentrations thal to ten fish (12 to 16 g) taken directly from rout Lake, and twenty fish (10 to 83 g) from rout Lake which were acclimatized to aerated onds were 0.36 mg and 0.45 mg/liter respectively. uring the summer yellow perch from Grassy Lake ere still more tolerant to low oxygen than those om Trout Lake. Mean oxygen concentrations thal to twenty fish (8 to 38 g) from Grassy Lake, nd eighteen fish (9 to 22 g) from Trout Lake were .32 and 0.81 mg/liter, respectively.
W70-09671

MERCURY IN THE MARINE ENVIRONMENT,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05A.
W70-09677

5-DIMETHYLAMINONAPHTHALENE-1-SULFONIC ACID (DANS ACID) AS STANDARD FOR QUANTUM YIELD OF FLUORESCENCE,
Georgia Univ., Athens. Dept. of Entomology.
Chester M. Himel, and Richard T. Mayer.
Analytical Chemistry, Vol 42, No 1, p 130-132, January 1970. 3 p, 1 fig, 1 tab, 21 ref. NIH Grant ES00207.

Descriptors: *Insecticides, *Biochemistry, *Enzymes, *Inhibitors, *Tracers, Analytical techniques, Metabolism, Pigments, Spectrophotometry, Spectroscopy, Fluorescence, Organic compounds, Insects, Animal physiology.
Identifiers: Fluorescence spectroscopy, Insect biochemistry.

As part of a study of the mechanism and mode of action of biologically active molecules, an extensive series of fluorescent probe molecules have been designed and synthesized. Fluorescent probes are defined as fluorescent molecules whose spectral response (quantum yield and fluorescence excitation and emission) vary as a function of the biophysical environment with which the probe is associated. This paper is concerned with the suitability of DANS Acid (1) as a quantum yield standard and also reports the quantum yield of p-N methyl, N (5-dimethylaminonaphthalene-1-sulfonamido) phenol (DMP) (2), a new fluorescent probe model compound. (See also W70-06754; W70-09682 and W70-09770) (Knapp-USGS)
W70-09683

EFFECTS OF DEICING SALTS ON WATER QUALITY AND BIOTA-LITERATURE REVIEW AND RECOMMENDED RESEARCH,
Virginia Polytechnic Inst., Blacksburg.
R. E. Hanes, L. W. Zelazny, and R. E. Blaser.
National Cooperative Highway Research Program Report 91, 1970. 70 p, 5 append.

Descriptors: *Deicers, *Highways, *Water pollution, *Sodium chloride, *Calcium chloride, Runoff, Infiltration, Wells, Ponds, Lakes, Toxicity, Ecology, Path of pollutants, Water pollution sources.

The use of sodium chloride and calcium chloride to aid in the removal of snow and ice from roadways has become an integral part of normal highway maintenance operations in areas of the country that experience significant snowfall. This report was prepared following a thorough review of literature pertaining to the effects of the deicing salts on roadside vegetation, water quality, and animal life. In addition to a current state-of-the-knowledge review with regard to the extent of the problem, it contains suggestions for alleviation of some of the detrimental effects caused by use of the deicing chemicals and identification of research needs, particularly in the area of the influence of the salts on domestic and wildlife water supplies. The report will be useful to highway personnel with specific responsibilities for maintenance, roadside development, and drainage. In view of the increasing concern about pollution of the environment, many other highway engineers, administrators, planners, and contractors, plus persons outside of the highway field, may also find it of interest. (Woodard-USGS)
W70-09705

ENVIRONMENTAL POLLUTION FROM HIGHWAY DEICING COMPOUNDS,
Maine Univ., Orono. Dept. of Plant and Soil Sciences.
F. E. Hutchinson.
Journal of Soil and Water Conservation, Vol 25, No 4, p 144-146, July-August 1970. 3 p, 1 fig, 3 tab, 7 ref. OWRR Project A-007-ME.

Descriptors: *Water pollution effects, *Sodium chloride, *Highway icing, *Snow removal, *Maine, Deicers, Roads, Chemcontrol, Salts, Groundwater, Leaching, Saline soils, Saline water.
Identifiers: Highway ice removal.

During the period 1965-1969, a study was made to determine what environmental pollution, if any, resulted from the average annual application of 25 tons of sodium chloride to each mile of paved highway in Maine. Analyses of water samples indicated that wells and farm ponds were seriously contaminated with chloride ions. Soil sample analyses revealed that soils contiguous to highways contained sodium levels that threaten vegetation and soil drainage. Concentrations of these ions in rivers apparently were not influenced by this practice. (Knapp-USGS)
W70-09844

PRELIMINARY OBSERVATIONS OF THE HYDROMECHANICS, NUTRIENT CYCLES AND EUTROPHICATION STATUS OF LAKE KINNERET (LAKE TIBERIAS),
Limnological Lab., Tabigha (Israel).
For primary bibliographic entry see Field 02H.
W70-09889

NITROGEN DISTRIBUTION IN SOME WISCONSIN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02H.
W70-09891

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
For primary bibliographic entry see Field 02H.
W70-09893

EFFECT OF EUTROPHY AND DESALINATION ON THE PHYTOPLANKTONIC POPULATIONS, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume; and Centre Universitaire de Luminy, Marseille (France). Laboratoire d'Hydrobiologie Marine.
For primary bibliographic entry see Field 02L.
W70-09897

SOME EFFECTS OF DETERGENTS IN THE MARINE ENVIRONMENT,
University of Strathclyde, Glasgow (Scotland). Dept. of Biology.
E. J. Perkins.
Chemistry and Industry, Vol 1, p 14-22, 1970. 5 fig, 10 tab, 4 ref.

Descriptors: *Detergents, *Sea water, *Environment, Mollusks, Crabs, Toxicity, Fisheries, Enzymes, Physicochemical properties, Hydrogen ion concentration, Salinity, Mortality, Animal behavior, Water pollution effects, Surfactants, Gastropods.
Identifiers: Nucella lapillus, Littorina saxatilis, Littorina littorea, Mytilis edulis, BP 1002, Dasic 'Slickgone', Petrofina 'Tarsolvent', Buccinum undatum, DS 4359, Carcinus maenas, Eupagurus, Psammechinus miliaris, Mucus secretion, Median tolerance limit, Delayed mortality, Oil emulsifiers.

Generally, detergents have considerable toxicity, ranging from -1 to more than 1000 ppm. During an evaluation of detergents' effects, the growth of shore-dwelling gastropod molluscs was studied because they could be easily and permanently marked, and could be released to and recovered readily from the shore. Littorina saxatilis, Littorina littorea, and Nucella lapillus were investigated for growth after treatment with a range of acute and apparently sub-lethal concentrations. Information on mortality and effects of predation upon treated animals was obtained. The effects of detergents on the closing of the operculum may be due to enzyme inhibition reactions, interaction between the detergents and other toxic substances present in seawater, or physico-chemical interactions between the detergents and seawater, and possibly the mucus secretion on the animal body. It is shown that the median tolerance limit derived from a short period recovery technique is a poor indicator of long term mortality due to dosage by detergents. Both mortality and inhibition of growth may be significant at very low concentrations, while inactivation may have more effect upon survival than mean tolerance limit. (Jones-Wisconsin)
W70-09899

MAN'S INFLUENCE ON LAKE ERIE,
Southern Illinois Univ., Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 02H.
W70-09900

A SIMPLE, INEXPENSIVE ALGAL CHEMOSTAT,
North Carolina State Univ., Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 07B.
W70-09904

IMPLICATIONS OF MICROBIAL POLYMER SYNTHESIS IN WASTE TREATMENT AND LAKE EUTROPHICATION,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 05D.
W70-09936

THE CONDITION OF LAKES AND PONDS IN RELATION TO THE CARRYING OUT OF TREATMENT MEASURES,
P. J. Laurent, J. Garaucher, and P. Vivier.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 10 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Lakes, *Ponds, *Waste water treatment, *Sewage treatment, *Biology, *Nitrification, Dissolved oxygen, Water pollution, Thermal stratification, Depth, Microorganisms, Microbiology, Eutrophication.
Identifiers: Chemical compositions, Leman Lake, Annecy Lake, Nantua Lake.

Several aspects of the pollution and associated nitrification occuring in the three largest freshwater lakes in eastern France are presented. In addition the remedial measures being carried out or proposed are described. Data are presented on two of the lakes with respect to percentages of saturation of dissolved oxygen and temperature from 1937 to 1968. For one of the lakes the nitrates in the deep water have nearly doubled in ten years and the total phosphorus is increased from 15 to 25

micrograms/l for the whole lake. Biological studies were done through the collection of samples of net plankton. The counts of each main group of algae are tabulated and give additional information about the changes in the lakes. The measures taken against eutrification were provision of the towns with mechanical and biological treatment systems followed by the chemical removal of phosphorus. After a great technical and financial effort in 1968, the equivilant of 44% of the litoral population was connected to these stations. The sanitary improvement has also dealt with the treatment through composing of garbage; formerly a large part of the refuse was disposed in streams and carried into the lake during the flood period. One lake seems to have stopped its trends towards increasing nitrification. For another of the lakes despite the employment of mechanical and biological treatment unfavorable chemical and biological evolution has taken place. (Hancuff-Texas)
W70-09941

ACUTE TOXICITY OF TWO ORGANIC MERCURY COMPOUNDS TO THE TELEOST, ORYZIAS LATIPES, IN DIFFERENT STAGES OF DEVELOPMENT,
Toho Univ., Tokyo (Japan). Dept. of Biology.
Akio Akiyama.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 36, No. 6, 1970, p 563-570. 4 fig, 2 tab, 13 ref.

Descriptors: Bioassay, *Toxicity, Heavy metals, *Fish eggs, *Lethal limit, Fungicides, *Embryonic growth stage, Copper sulfate, Mode of action, Regression analysis, Resistance.
Identifiers: *Mercury, *Oryzias latipes, PMA, MEMC, Uspulum, *Mercuric chloride, *Phenylmercuric acetate, *Metoxygethylmercuric chloride.

The differential susceptibility of eggs, developing embryos, fry, and adult of a cypridont fish, Oryzias latipes, have been studied on the base of the 24-hour Median Tolerance Limit (TLm) to the organic mercury compounds, phenylmercuric acetate and metoxyethylmercuric chloride. Metoxyethylmercuric chloride was less toxic than phenylmercuric acetate. To metoxyethylmercuric chloride, 24-hour TLm for eggs, fry, and adult was 0.50-1.30, 1.48 and 1.74 ppm, respectively, while to phenylmercuric acetate, 0.18-0.26, 0.03, and 0.21 ppm, respectively. Adult fish were more tolerant than fry, but eggs in the solution of PMA were most resistant. In developing embryos, 24-hour TLm to the organic mercury compounds gradually increased through the early stage, passed through a maximum to the median phase, at 5 day old, and finally fell off in the later phase, in a general minimum. With the process of growth of fish, 24-hour TLm increased logarithmically. (Sjolseth-Washington)
W70-09970

TOXICITY EVALUATION OF A TECHNIQUE FOR INTRODUCING DIELDRIN INTO WATER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 05A.
W70-09971

CONCENTRATIONS OF TRACE ELEMENTS IN GREAT LAKES FISHES,
Argonne National Lab., Ill.; and Bureau of Commercial Fisheries, Ann Arbor, Mich.
Henry F. Lucas, Jr., David N. Edgington, and Peter J. Colby.
Journal Fisheries Research Board of Canada, Vol. 27: 677-684, 1970. 2 tab, 12 ref.

Descriptors: *Trace elements, Heavy metals, *Great Lakes, Lake Michigan, Lake Superior, Lake Erie, Toxicity, Fish toxins, Perches, Alewife, Cobalt, Chromium, Copper, Gold, Water pollution sources, Neutron activities analysis, Shiners.
Identifiers: Uranium, Thorium, Cadmium, Arsenic, Antimony, Lanthanum, Rhenium, Rubidium, Selenium, *Tissue analyses, Bromine, Fish livers.

The concentration of 15 trace elements was determined by activation analysis of samples of whole fish and fish livers from three of the Great Lakes; Michigan, Superior, and Erie. The average concentrations of 7 elements in 19 whole fish from 3 species were as follows: uranium, 3 ppb (parts per billion); thorium, 6 ppb; cobalt, 28 ppb; cadmium, 94 ppb; arsenic, 16 ppb; chromium, 1 ppm; and copper, 1.3 ppm. The average concentrations of 8 elements in 40 liver samples from 10 species of fish were as follows: uranium, approximately 2 ppb; thorium, less than or equal to 2 ppb; cobalt, 40 ppb; copper, 9 ppm; zinc, 30 ppm, bromine, 0.4 ppm; arsenic, 30 ppb; and cadmium, 0.4 ppm. Other elements observed in most of the samples were: antimony, 5-100 ppb; gold, 2-5 ppb; lanthanum, 1-20 ppb; rhenium, 0.5-5 ppb; rubidium, 0.06-4 ppm; and selenium, 0.1-2 ppb. Trace element concentrations varied with species and lake. Uranium and thorium varied with species, but not for the same species from different lakes. The levels of copper, cobalt, zinc, and bromine varied little between species and lakes. The concentration of cadmium, arsenic, and chromium varied between species and with species between lakes. (Sjolseth-Washington)
W70-09972

INFLUENCE OF PENTACHLOROPHENOL ON FATTY ACIDS OF COHO SALMON (ONCORHYNCHUS KISUTCH),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
D. Hanes, H. Krueger, I. Tinsley, and C. Bond.
Proceedings of the Western Pharmachological Society II, p 121-125, 1968. 2 fig, 2 tab, 3 ref. PHS Grants 1T1 GM 1192 and EF 105.

Descriptors: Animal metabolism, *Fish physiology, *Biochemistry, Water pollution effects, *Lipids, Toxicity, Growth rates, Length, Mode of action, Fish diets, Laboratory tests.
Identifiers: Coho salmon, *Pentachlorophenol, *Fatty acids, Catabolism, Fatty acide methyl esters, Metabolic rate.

Control salmon catabolized 25% of their available fatty acids (mass in diet plus mass in Day 0 salmon) over a 14-day period compared to 47% in KPCP poisoned salmon. Individual fatty acids showed a tendency to be either lost or conserved due to their different rates of net catabolism. The tendency of each acid to be lost or conserved was the same in both untreated and KPCP (potassium pentochlorophenal) poisoned salmon. The excess net catabolism of each fatty acid in salmon under KPCP poisoning was directly proportional to the available mass of that fatty acid. (Sjolseth-Washington)
W70-09973

INFLUENCE OF OXYGEN CONCENTRATION ON THE GROWTH OF JUVENILE COHO SALMON,
Oregon State Univ., Corvallis. Dept. of Fish and Game Management.
Robert B. Herrmann, Charles E. Warren, and Peter Doudoroff.
Transactions American Fisheries Society, Vol. 91, No. 2, 1962, p 155-167. 3 fig, 2 tab, 15 ref. PHS Grant RG 4352.

Descriptors: *Oxygen requirements, Dissolved oxygen, Mode of action, Water temperature, Laboratory tests, *Growth rates, Mortality, Animal metabolism, Water pollution effects, Fish physiology, Fish management, *Bioassay, Lethal limit, Fishkill, *Fish behavior.
Identifiers: *Coho salmon, *Food consumption rates, *Food conversion rates.

Juvenile coho salmon were held at 20 deg C. in 12-gallon bottles, usually 10 to a bottle, in continuously renewed fresh water having various dissolved oxygen concentrations. In most of the experiments, the fish were fed beach hoppers to repletion twice daily so that food was available for 10 hours each day. Growth and food consumption rates of age-class 0 juveniles observed in the year 1956 declined slightly with reduction of oxygen concentrati from a mean of about 8.3 to 6 and 5 mg/l, s declined more sharply with further reduction of ygen concentration. Food conversion ratios w slightly depressed at concentrations near 4 m and were markedly reduced at lower concent tions. At concentrations averaging 2.1 to 2.3 m many fish died and surviving fish consumed very tle food and lost weight. Interesting seasonal var tions were noted of the dissolved oxygen requi ments of coho salmon, their food and oxygen c sumption rates, and their gross food conversion ficiencies. The conversion efficiencies apparen increased, whereas food consumption ra declined in the fall of 1956. The seasonal variatio are not ascribable entirely to size differenc (Katz-Washington)
W70-09974

THE INFLUENCE OF OXYGEN CONCENTRATION ON THE SWIMMING PERFORMANCE OF JUVENILE PACIFIC SALMON AT VARIOUS TEMPERATURES,
Oregon State Univ., Corvallis. Dept. of Fish an Game Management.
Gerald E. Davis, Jack Foster, Charles E. Warren, and Peter Doudoroff.
Transactions American Fisheries Society, Vol. 9 No. 2, 1963, p 111-124. 5 fig, 2 tab, 18 ref. PH Grant RG 4352.

Descriptors: *Chinook salmon, *Oxygen require ments, Dissolved oxygen, Laboratory tests, *Fis physiology, Fish behavior, Swimming, Water tem perature, Oxygenation, Laboratory equipmen Animal metabolism, Water pollution effects, The mal stress, Performance.
Identifiers: *Coho salmon, *Swimming pe formance, Hemoglobin content.

The sustained swimming speeds of juvenile coh and chinook salmon tested in a tubular chamber a temperatures ranging from 10 to 20 deg C. usuall were dependent on the disolved oxygen concentra tion at any tried concentration below the air-satu ration level. Reduction of oxygen concentratio from air saturation levels to 7,6,5,4 and 3 mg/ usually resulted in reduction of the maximum sustained swimming speed of coho salmon by abou 5, 8, 13, 20 and 30 percent, respectively. These percentages are based on the observed per formance of the first-failing and second-failing in dividuals of a group of five fish used in a per formance test. The corresponding estimated per cent reductions of the swimming speed of first-fail ing fish in most of the early exploratory experi ments with chinook salmon were somewha greater, averaging approximately 10, 14, 20, 27 and 38 percent, respectively. Within the ranges of tested concentrations above the saturation levels, variations of oxygen concentration had little or no effect on the performance of wild underyearling and hatchery-reared yearling coho salmon. The performance of the wild underyearlings at tested oxygen concentrations improved progressively with increase of temperature from 10 to 15 and to 20 deg C. (Sjolseth-Washington)
W70-09975

RECOVERY OF A SALT MARSH IN PEMBROKESHIRE, SOUTH-WEST WALES, FROM POLLUTION BY CRUDE OIL,
K. J. M. Baker, and E. B. Cowell.
Biological Conservation, Vol. 1, No. 4, July 1969, p 291-295. 2 fig, 2 tab, 8 ref.

Descriptors: Resistance, Water pollution effects, *Salt marshes, Oily water, *Oil, *Marine algae, Water pollution sources, On-site data collections, *On-site investigations, Frequency, *Frequency analysis.
Identifiers: *Recovery, Oil spill, *Oil pollution, *Filamentous green algae, Halimone portulacoides, Suaeda maritima, Aster tripolium, Pembroke, South-west Wales.

Gentlass Salt Marsh, near Pembroke, south-west Wales, was polluted by Kuwait crude oil in January 1967. Frequency data taken in June 1966, June 1967, and June 1968, show that some species were more affected than others by the oil. In June 1967, Suaeda maritima, Salicornia spp., Halimione portulacoides, and filamentous green Algae, showed the greatest reduction of frequency, while Aster tripolium, Cochlearia spp., Triglochin maritima, Puccinellia maritima, Juncus gerardi, Limonium humile, and Spartina townsendii showed some reduction. At the time frequencies of Festuca rubra, Plantago maritima, Armeria maritima, Artemisia maritima, Glaux maritima, and Spergularia spp., were not significantly lower than the pre-spill levels. By June 1968 most of the species which were affected in 1967 showed some recovery, the exception being Triglochin maritima, the ill-effect on which had increased. The species with the greatest coverage, Festuca rubra in the upper marsh, Puccinellia maritima in the mid-marsh, and Spartina townsendii in the lower marsh, had all recovered more or less completely by June 1968. (Sjolseth-Washington)
W70-09976

DISSOLVED OXYGEN REQUIREMENTS OF DEVELOPING STEELHEAD TROUT AND CHINOOK SALMON EMBRYOS AT DIFFERENT WATER VOLOCITIES,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Stuart J. Silver, Charles E. Warren, and Peter Doudoroff.
Transactions American Fisheries Society, Vol. 92, No. 4, 1963, p 327-343. 7 fig, 7 tab, 11 ref. PHS Grant RG 4352.

Descriptors: Fish physiology, Growth rates, Dissolved oxygen, *Oxygen requirements, *Chinnok Salmon, Laboratory tests, *Embryonic growth stage, Fish eggs, Environmental effects, *Hatching, *Viability, *Mortality, Length, Weight, Fish reproduction, Laboratory equipment, Spawning, Hatching success.
Identifiers: *Steelhead trout, *Water velocity, *Size differences, Hatching size, Spawning success, Hatching time, Hatching success.

Embryos of steelhead trout and chinook salmon, were reared from fertilization of the eggs to hatching at different constant oxygen concentrations and water velocities. Measurements of the embryos and hatched fry indicate that water velocities must be high enough not only to transport enough oxygen to the redd for supplying the total requirement of all embryos, but also to deliver sufficient oxygen to the surface of the chorion enveloping the individual embryo. Steelhead embryos held at 9.5 deg C. and chinook salmon embryos held at 11 deg C. all died at an oxygen concentration of 1.6 mg/l. Survival of large percentages of embryos reared at concentration as low as 2.5 mg/l was apparently made possible by reduction of respiration rates and consequent reduction of growth and development rates. Sac fry from embryos reared at low and intermediate oxygen concentrations were smaller and weaker than sac fry from embryos reared at high concentrations. The size of steelhead trout and chinook salmon fry at hatching probably was dependent on water velocity even at velocities as high as 740 and 1,350 cm/hr, respectively, and on oxygen concentration even at concentrations near saturation levels. (Sjolseth-Washington)
W70-09977

ORGANOCHLORINE INSECTICIDES IN RAINBOW TROUT FROM THREE NORTH ISLAND LAKES,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
S. R. B. Solly, and Valerie Shanks.
New Zealand Journal of Marine and Freshwater Research, Vol. 3, No. 4, December 1969, p 585-590. 4 tab, 8 ref.

Descriptors: *Pesticide residues, Rainbow trout, Gas chromatography, *DDT, Chlorinated hydrocarbon pesticides, *Heptachlor, *Dieldrin, Water pollution effects, On-site data collections, Surveys, Analytical techniques.
Identifiers: *DDD, *DDE, *New Zealand, *Lindane, *Heptachlor epoxide, Rotorua.

From 12 rainbow trout (Salmo gairdneri Richardson) taken from each of three lakes, (Rerewhakaaitu, Opouri and Okataina) in the Rotorua district, N. Z., samples of liver, skeletal muscle and, from mature fish, the gonards were examined for organochlorine insecticides. Lindane, Heptachlor and heptachlor epoxide were not detected in any of the samples. Traces of dieldrin were detected only in trout taken from Rerewhakaaitu Lake. In all fish examined, pp'-DDT, pp'-DDD and pp'-DDE were detected all three tissues. The highest concentrations were found in some of the ovaries of fish from Rerewhakaaitu Lake, the catchment area of which had been extensively topdressed with DDT. Although most of the catchment area of Lake Okataina had never been topdressed with DDT, fish from this lake contained small amounts of DDT and its metabolites. (Sjolseth-Washington)
W70-09978

5D. Waste Treatment Processes

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY.
Federal Water Quality Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-09558

WATER TEMPERATURE CONTROL WEIR FOR MERAMEC PARK DAM, MERAMEC RIVER, MISSOURI,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Joseph P. Bohan.
U.S. Army Engineer Waterways Experiment Station, Technical Report H-70-1, Feb. 1970. 32 p, 4 fig, 6 photo, 7 plates.

Descriptors: *Temperature control, *Stratified Flow, Hydraulic models, Thermocline, Water temperature, Weirs, Control Equipment, Water quality control, Withdrawal.
Identifiers: *Meramec Park Dam.

Tests were conducted on a 1:40-scale model of the water temperature control weir for the Meramec Park Dam to investigate the discharge characteristics of the weir and determine its effectiveness in preventing the release of cold water from the hypolimnion. The model consisted of a section of the approach channel, the control weir, and the intake structure. Density stratification caused by temperature differentials in the prototype was simulated in the model by using saline and fresh waters. The weir was found to be effective for containing the cold water during release of desired rates of flow of 131 to 1028 cfs from the water supply and water-quality control (joint use) pool (el 608.0 to 675.0). Some withdrawal of cold water (approximately 7 percent) was observed with a discharge of 8000 cfs and a pool elevation of 680.0. The results of this study and similar tests on the Clarence Cannon and West Point water temperature control weirs were used to develop a preliminary, generalized technique for predicting the effectiveness of submerged weirs. (Hsieh-Vanderbilt)
W70-09602

PLUME EFFECTS OF NATURAL DRAFT HYPERBOLIC COOLING TOWERS,
Gilbert Associates, Inc., Reading, Pa.; and Metropolitan Edison Co., Reading, Pa.
For primary bibliographic entry see Field 05C.
W70-09604

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS,
Cornell, Howland, Hayes and Merryfield, Portland, Oreg.
Donald M. Marshe.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 57-106, June 22-23, 1970. 13 figs, 6 tab, 2 ref. FWQA Contract 14-12-128.

Descriptors: *Primary treatment, *Storm flow, Sewers, Overflow, Sewage treatment, Estimated cost.
Identifiers: *Screening, Combined sewer systems.

This study sought to determine the feasibility, effectiveness, and economics of employing high-rate, line-mesh screening for primary treatment of storm water overflow from combined sewer systems. The final form of the screening unit stands 63 inches high and has an outside diameter of 80 inches. The unit is fed by an 8-inch pipe carrying 1700 gpm (122 gal/min/ft sq) which is distributed to a 60-inch diameter rotating (60 rpm) stainless steel colar screen having 14 square feet of available screen area and a 165 mesh (105 micron opening, 47.1 percent open area). The screen is back-washed at the rate of 0.235 gallons of backwash water per 1000 gallons of applied sewage. Based on final performance tests run on dry-weather sewage, the unit is capable of 99 percent removal of floatable and settleable solids, 34 percent removal of total suspended solids and 27 percent removal of COD. The screened effluent is typically 92 percent of the influent flow. On the basis of a scale-up design of a 25 mgd screening facility, the estimated cost of treatment is 22 cents/1000 gallons. No finite cost comparisons were made with other treatment methods; however, when compared to conventional primary sedimentation, the selection of a screening facility as a treatment method is dependent on the value and availability of land, the design capacity of the treatment facility, the character of rainfall and runoff, and the means of disinfection. It was observed that the proposed screening facility required 1/10 to 1/20 the land required by a conventional primary treatment plant. (See also W70-09558). (Marriott-Chicago)
W70-09616

ASSESSMENT OF COMBINED SEWER PROBLEMS,
American Public Works Association, Chicago, Ill.
Richard H. Sullivan.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 107-121, June 22-23, 1970. 8 fig.

Descriptors: *Storm drains, *Sewers, *Overflow, *Regulation, Regulated flow, Water pollution, Water pollution control, Water pollution treatment, Infiltration, Water quality, Maintenance, Hydrology.
Identifiers: Combined sewers, Regulators.

Problems of combined sewers are discussed generally and specific attention is given to problems of the combined sewer regulator and the capacity of the treatment plant. A recently conducted study of combined sewer system overflow regulator facilities and practices covering design, application, construction, control and operation and maintenance procedures, is detailed. The specific purpose of this project was to analyze and evaluate the effectiveness of practices and to establish long-needed guidelines for more efficient and dependable control of overflows and for reduction in the frequency and duration of combined sewer flows and the resultant pollution in waters receiving such spills. The function of a regulator is to regulate or control the amount of the flow which is allowed to enter the interceptor system and to divert the balance to holding or treatment facilities, or to discharge this balance to a point of disposal in nearby receiving waters. The study of combined

sewer regulators involved interviewing a group of jurisdictions and then in cooperation with a panel of consulting engineers preparing a report and a manual of practice. Of the seventeen jurisdictions only three were found to operate regulators designed to minimize pollution by assuring that the interceptor sewer is fully charged. These were in Seattle, Minneapolis-St. Paul, and Detroit. Some of the major findings and recommendations of the study call for a reduction in the number of overflows, total systems management of the combined sewer system, use of dynamic type regulators to allow response to hydraulic conditions in the sewers, use of regulators that improve the quality as well as the control of its quantity and the need for improved maintenance and design of regulator facilities. Infiltration control is also discussed briefly. (See also W70-09558). (Marriott-Chicago)
W70-09617

THE USE OF SCREENING/DISSOLVED-AIR FLOTATION FOR TREATING COMBINED SEWER OVERFLOWS,
Rex Chainbelt, Inc., Milwaukee, Wis.
Donald G. Mason.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 123-138, June 22-23, 1970. 9 fig, 4 ref. FWQA Contract 14-12-40.

Descriptors: Water pollution treatment, Flotation, Flocculation, Storm drains, Overflow, Urbanization.
Identifiers: Screening/flotation system, Milwaukee, Wisconsin.

The treatment of combined sewer overflow by screening and dissolved-air flotation was studied. The objectives were to determine the effectiveness and cost of a screening/flotation system. A combined sewer (Hawley Road) in Milwaukee, Wisconsin was monitored and laboratory testing which included screening, chemical oxidation, and dissolved-air flotation was performed. The results of the tests indicated a combination of screening flotation provided a feasible system and a prototype demonstration unit with a 5 mgd capacity was designed and installed. The system has been operated on 30 overflows. Removals of BOD, COD, SS, and VSS have been in the range of 50-75%. The waste solids stream has averaged only about one per cent by volume of the raw feed water. Operation has been very satisfactory with a minimum of maintenance required. Chemical flocculants have been utilized to increase the removal efficiencies to the upper values of the above range. Cost estimates have been made and these indicate a total installed cost of $12,000 per mgd capacity. Operating costs are estimated at 1.0cents/1000 gallons without chemical flocculant addition. Chemical costs should be in the range of 2.0-2.5cents/1000 gallons. Based on the results of this study screening/flotation offers an alternate to sewer separation in some areas. The project is scheduled for completion in early summer 1970. (See also W70-09558). (Marriott-Chicago)
W70-09618

UNDERFLOW PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Metropolitan Sanitary District of Greater Chicago, Ill. Dept of Public Works and Buildings.

In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 139-218, June 22-23, 1970. 20 fig, 9 tab, 8 ref.

Descriptors: *Underground storage, *Underflow, Sewers, Water pollution control, Flood control, Water storage, Storm runoff, Underground structures, Construction, Tunnels, Permeability, Dolomite, Limestone, Tunneling machines.
Identifiers: Underflow-storage Plan, Deep Tunnel Plan, Chicago Drainage Plan, Chicagoland area.

To solve the problems of flooding and water pollution in the Chicagoland area, a number of plans have been proposed and studied. Three of these plans, the Underflow-Storage Plan, the Deep Tunnel Plan and the Chicago Drainage Plan, are still viable alternates for the total solution to meet the water quality standards established by the state and Federal Governments and the requirements of handling the runoff from a 100-year storm. During the study of the Underflow-Storage Plan, it was decided to modify a large relief sewer proposed by the City of Chicago, as an Underflow Sewer similar to the metropolitan area-wide plan but on a much smaller scale. The Underflow Sewer would be constructed in solid rock, 250 feet below the ground surface. This sewer as well as two additional Underflow Sewers are under construction by the Metropolitan Sanitary District at widely separated locations in the Chicago area in the same dolomitic limestone rock formation. Construction of these sewers has confirmed the structural integrity and dense impermeability of this underlying rock blanket throughout the entire Chicago area. Further evaluation of the three plans indicates that portions of the Underflow-Storage Plan designated for the First Phase construction are compatible with further extensions along the general conceptual lines of any of the three plans. It is recommended that the final design of the First Phase work proceed and that all alternates for the Second Phase be thoroughly and systematically studied concurrently to determine the final plan. (See also W70-09558). (Marriott-Chicago)
W70-09619

SURVEY OF WATER UTILIZATION AND WASTE CONTROL PRACTICES IN THE SOUTHERN PULP AND PAPER INDUSTRY,
North Carolina Water Resources Research Inst., Raleigh.
Peder J. Kleppe, and Charles N. Rogers.
Available from the NTIS as PB-194 053, $3.00 in paper copy, $0.65 in microfiche. Report No. 35, Water Resources Research Institute of the University of North Carolina, June 1970. 77 p, 11 tab, 5 fig, 3 ref, 3 append. OWRR Project A-036-NC (1).

Descriptors: Pulp and paper industry, *Pulp wastes, *Industrial wastes, Water pollution sources, Water use industrial, *Water utilization, *Industrial plants.

The state of water usage and water pollution abatement in the Southern Pulp and Paper Industry was studied by surveying forty-six mills which produce about 60% of the total pulp and paper output of this region. The study covered use and treatment of fresh water, reuse of water in the mills, the amount of waste water and pollutants, waste treatments, and sludge disposal. The amount of waste water from the surveyed mills amounted to about 1,200 million gallons per day containing about 2.5 million pounds of BOD which was reduced to about 1.3 million pounds after treatment. Six areas of research are recommended: (1) Optimization of waste management; (2) Optimum reuse of process water; (3) Development of economical and non-polluting pulping and bleaching processes; (4) Obtaining completely closed water systems in pulp and paper mills; (5) Improvement of the present primary, secondary, and tertiary waste treatment processes, and the utilization of the products from these processes; and (6) Developing nonpollutant and economically feasible recovery processes for fibers from waste paper and board.
W70-09668

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.
For primary bibliographic entry see Field 05G.
W70-09741

PHILADELPHIA'S PLANS TOWARD INSTRUMENTATION AND AUTOMATION OF THE WASTE WATER TREATMENT PROCESSES,
Philadelphia Water Dept., Pa.
C. F. Guarino, and G. W. Carpenter.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 11 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Instrumentation, *Automation, *Programs, Mathematical model, Computers, Information retrieval, Data processing.
Identifiers: *Philadelphia, Pennsylvania, *Flow diagram.

For the past several years, the City of Philadelphia has been working towards the instrumentation and automation of the Northeast Water Pollution Control Plant. The plant is designed to treat 175 MGD with a combined average suspended solids and biochemical oxygen demand removal of approximately 75%. The data logging program named 'Nelog', which has been in use since January 1967 reduces the time required for record keeping, minimizes human errors, and enables analysis of data which would be impractical if attempted manually. The computer generates a monthly operational report as well as a monthly summary and an annual report. The Nelog program evaluates the data and produces an output listing any deviation from that which is considered normal or acceptable. This report is brief and enables the technical personnel to review and/or reject questionable data. The Philadelphia Water Department conceived a master plan for the automation of the Northeast Water Pollution Control Plant entitled 'NE-PAT', Northeast Plant Automated Treatment. The initial phase includes all the necessary steps leading to a digital computer system installed on line at a secondary waste water treatment plant. Data that will be collected by the system shall include dissolved oxygen, total suspended solids, turbidity, BOD, TOC, COD, sludge volume index, nutrients (N and P both Total and Ortho) CO_2, CH_4, total dissolved solids (effluent) and settleability of sludges. (Hancuff-Texas)
W70-09742

EXTENDABLE SEWAGE PLANT IN PACKAGE TYPE CONSTRUCTION FOR RAPIDLY EXPANDING COMMUNITIES UP TO 25,000 INHABITANTS,
Technische Hochschule, Aachen (West Germany). Institut fuer Siedlungswasserwirtschaft.
B. Boehnke.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 7 p, 6 fig.

Descriptors: *Sewage treatment, *Waste water treatment, Organic loadings, *Activated sludge, Stabilization.
Identifiers: *Package plants.

The problems of waste water disposal in small and medium sized communities requires reliable sewage plants which could be easily overloaded in the case of quickly or rapidly growing communities. It must be possible to hold within safe limits the disturbance to a waste water purification plant in agricultural drainage areas caused by liquid manure, farm wastes and other waste water shock. The technique described incorporates a ten fold increase in flow quantity in the case of rain and a five fold overload of the biological stage. For a quick improvement of many overloaded plants a typical development is shown which permits rapid design work and examination by the official local control bodies. The use of flat foundation ducts for the buildings permits the employment of local contractors and saves expense in excavation. Separation of the drive sets for sewage circulation and oxygen supply provides favorable energy economic ratios. The coupling of the oxygen supply with sludge return from the secondary clarification to the aeration basin also favors an economical use of energy. Building cost evaluations show a basic type treat-

nt for 1,000 to 5,000 inhabitants can be built at irly reasonable expense. Further expansions up 25,000 show expenditures which lie in the cost ge of ordinary compact sewage treatment nts. (Hancuff-Texas)
0-09744

RUS REMOVAL IN WASTE WATER NOVATION BY CHEMICAL COAGULA-ON AND FLOCCULATION,
nois Univ., Urbana.
Chaudhuri, and R. S. Engelbrecht.
th International Water Pollution Research Con-ence, San Francisco, July 26 - August 1, 1970. eprint, 21 p, 10 fig, 7 tab, 56 ref.

scriptors: *Viruses, *Coagulation, *Floccula-n, *Waste water treatment, Chemical precipita-n, Colloids, Sewage treatment, Aluminum, Ad-rption, Bacteriophage.
entifiers: Waste water renovation, T 4 viruses, S2 viruses.

ruses are colloidal particles and in domestic aste water many of them are of public health sig-ficance. Clarification by floc formation (coagula-n of flocculation) and filtration removes a large action of viruses from waste waters. Although ta on removal of viruses by coagulation floccula-n are available, little attention has been given to e basic mechanism involved. Removal of viruses chemical coagulation flocculation with allu-inum sulphate comprises a primary instantaneous ert reaction between virus coat protein and alu-inum which results possibly in the formation of ordination complexes between aluminum and e carboxyl group of the virus coat protein. This is llowed by incorporation into the precipitating ydrated aluminum oxide species and subsequent occulation and sedimentation. The process of hemical coagulation flocculation cannot be ex-ected to operate with high virus removal efficien-y in waste water renovation, as compared to water reatment because of the presence of organic natter in waste water effluent. Virus particles emoved in the settled floc are not inactivated but emain active. Therefore proper care should be aken in the disposal of sludge from coagulation locculation operations in waste water renovation. (Hancuff-Texas)
W70-09745

TECHNOLOGY OF PLASTIC MEDIUM TRICK-LING FILTERS,
Ruhrverband, Essen (West Germany).
G. Rincke, and N. Wolters.
Fifth International Water Pollution Research Con-ference, San Francisco, July 26 - August 1, 1970. Preprint, 9 p, 7 fig, 1 tab, 17 ref.

Descriptors: *Plastics, *Trickling filters, *Technology, Hydraulics, Biological treatment, Phosphorus, Films, Microorganisms, Microbiology, Waste water treatment.

Several influences and variables of the tricking filter are discussed from an elementary point of view. In preliminary studies filling materials with 225 to 270 m sq/m cu specific surface showed better performance than those with 90 to 160 m sq/m cu. At arising BOD load the amount of removal substrate increases but not proportionally. At a constant loading the hydraulic feeds in princi-ple can exert several influences on the removal: (1) a change in water quantity results in the reciprocal change of the substrate concentration, (2) the decrease of hydraulic feed can have the effect that at below a certain value the total wetting of the biological film is no longer achieved. A test pro-gram was carried out in which organic loading and hydraulic feed were varied independently of each other over wide ranges. Investigations at a constant feed 13.2 cubic meters per meter hour showed a continuous increase of removal with higher surface loading. However a maximum removal was not achieved under these test conditions. At a constant organic loading there were only slight differences in the removal of organics depending on the hydraulic feed rate. At constant organic loading there was no distinct relationship shown between the influent concentration and removal. Decreased efficiency of BOD removal was also shown when phosphorus was lacking. (Hancuff-Texas)
W70-09746

A MATHEMATICAL MODEL FOR CONTACT STABILIZATION-MODIFICATION OF THE ACTIVATED SLUDGE PROCESS,
Toronto Univ., (Ontario).
P. H. Jones.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 7 p, 4 fig, 4 ref.

Descriptors: *Mathematical model, *Activated sludge, *Sewage treatment, Waste water treatment, Absorption, Hydrolysis, Computer programs.
Identifiers: *Contact stabilization, Laboratory studies.

The contact stabilization modification involves the mixing of a well conditioned activated sludge with a fresh unsettled raw waste water for a brief period. During this period of contact the sludge removes organic and inorganic pollutants by several mechanisms. The major mechanisms involved are absorption, adsorption and simple physical entrapment. Removal is extremely rapid but the organic material is not stabilized in this reactor. The initial contact is therefore followed by a solid-liquid separation usually by settling and the sludge containing the unstable organics is then admitted to a sludge reaeration tank. It is hypothesized that the three removal mechanisms occur simultaneously and are described by various mathematical models. Adsorption and physical entrapment are physical reactions and a function of: (1) the particulate material, (2) velocity gradient, (3) mixing operation and (4) concentration of solids in the form of floc. The reaction is assumed to obey a first order differential equation. Absorption is assumed to obey the same equation as the growth of microorganisms. Another equation is defined for the hydrolysis of the material. A computer program was written incorporating these variables and validated through the use of laboratory tests. A mathematical model was postulated and the calculated and observed curves matched quite closely. The complete computer program is presented. (Hancuff-Texas)
W70-09747

DYNAMIC PROGRAMMING FOR A SEWAGE TREATMENT SYSTEM,
Yachiyo Engineering Co., Tokyo, (Japan).
T. Futagami.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 12 p, 11 fig, 2 tab, 2 ref.

Descriptors: *Sewage treatment, *Dynamic programming, *Systems analysis, Mathematical models, Standards, Optimization, Water quality, Waste water treatment.
Identifiers: Flow chart, Grid method.

An optimal sewage system is studied by using dynamic programming. This dynamic programming is based on the principle of optimality and has the advantage of being able to handle the complicated planning problems. A mathematical model of river system is constructed for the application of dynamic programming. The concentration of the polluted material in the river and the treatment rate at each municipal waste water treatment plant are chosen as the state variable and the decision variable respectively. The objective function considered includes the construction cost and treatment cost at each waste water treatment plant and chemicals' costs for water supply. Taking account of the purification of river, the functional equations are derived for the application of dynamic programming. The recurrence formulae are derived to obtain the optimal planning. Finally, dynamic programming is applied to the Yodo River System by using the derived recurrence formulae and grid method. In this research the backward calculation procedure of dynamic programming is adopted. (Hancuff-Texas)
W70-09748

SECONDARY TREATMENT WITH GRANULAR ACTIVATED CARBON,
Calgon Corp., Pittsburgh, Pa.; and Willard F. Schade and Associates, Cleveland, Ohio.
J. L. Rizzo, and R. E. Schade.
Water and Sewage Works, Vol 116, No 8, August, p 307-312, 2 tab, 4 ref.

Descriptors: *Adsorption, *Activated sludge, *Activated carbon, *Biochemical oxygen demand, Tertiary treatment, Biological treatment, Isotherm, Sludge, Digestion, Phosphate, Waste water treatment.
Identifiers: *Suspended Solids, Polymers, Raw Sewage Contact Time, Backwaste.

A new waste water treatment process using granular activated carbon has been successfully tested. Based on the results of demonstration studies, low cost of construction and less land requirement are claimed to be the two primary advantages of this method over the conventional biological secondary treatment processes. The present method is an outgrowth of a need to expand the capacity of an established treatment plant. The aforementioned plan if adapted, will give more room for future expansion. Some of the works done by various other agencies in the application of activated carbon are also discussed. Results obtained from other demonstration projects are presented. The final design features of the granular activated carbon system are outlined and the various aspects which will be investigated during the first year of operation are enumerated. (Radhakrishnan-Texas)
W70-09749

OPTIMAL DEGREE OF SEWAGE WATER TREATMENT FOR EACH PROJECT OF THE COMPLEX,
State Water Conservation Inspection (USSR).
Y. P. Belichenko.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 4 p, 2 fig, 1 tab.

Descriptors: *Sewage treatment, *Waste water treatment, *Optimization, *Efficiencies, Mathematical model, Water pollution, Cost.
Identifiers: Water uses, Purification.

Economic difficulties in solving the problem of conservation of water sources from pollution become especially evident if one takes into account the ever increasing quantities of sewage waters to be discharged in the future, and also the high construction costs of treatment works (averaging 100 roubles per cum. of wastes discharged per day), required to treat these increased discharges. Hence it follows how important it it to search for ways of decreasing construction and maintenance costs for decontamination of sewage waters. The relationship between construction costs of works for treating the sewage waters to different of purity is known. This relationship can be generally expressed as a function of initial and final concentrations of a pollutant and sewage discharge. After determining the required concentration of a certain matter contained in sewage effluents discharged into a water stream by each project on condition of providing the critical, admissable concentration of this matter at a downstream water use site with miminum expenses for construction of treatment works the required cost of each project can be evaluated through an optimization technique. (Hancuff-Texas)
W70-09750

A STUDY OF OPERATIONAL ANOMALIES IN DIGESTION TANKS,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).

N. Westberg, and B. Ericsson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 9 p, 5 fig, 3 ref.

Descriptors: *Digestion, *Sludge treatment, *Digestion tanks, Circulation, Mathematical models, Waste water treatment, *Sewage treatment, Anaoerobic digestion.
Identifiers: *Digestion tanks, *Anomalies, Gas production, Gas removal.

Experimental runs have been carried out at the Jonkoping sewage plant, aimed at studying variation in the gas production cuased by intermittent feeding as well as intermittent pumping. At intermittent feeding the variations of the gas production during one day did not follow simple kinetic equations and showed two separate peaks, giving a picture of one primary and one secondary intensification of the gas production, thus indicating two successions of bacterial growth. On starting the circulation pump the gas production increased considerably and severe interference in the operation may arise, if the circulation rate is high enough. The intensity and durability of this increase depend upon the rate of circulation and the dimensions of the digester. Attempts have been made to develop mathematical formulae to describe the course of the variations. The calculated variations were greater than the experimental ones. Probably the deviations are primarily due to a very irregular flow pattern in the digester. The circulation flow seems to be concentrated in the central part of the digester. (Hancuff-Texas)
W70-09751

DEWATERING SEWAGE SLUDGE BY ELECTROOSMOSIS,
Rocketdyne, Canoga Park, Calif.
J. Greyson, and H. H. Rogers.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 14 p, 7 fig, 3 tab, 8 ref.

Descriptors: *Sludge, *Sludge treatment, *Sludge disposal, *Dewatering, *Electroosmosis, Costs.
Identifiers: Voltage, Power.

Electroosmotic pumping derives from the electrokinetic phenomenon of electroosmosis, i.e., the flow of water though porous matrices or constrained suspensions of fine particles that is associated with ion flow produced by an applied electric field. In contrast to conventional filtration, electroosmotic pumping is independent of the cross-sectional area of the pore structure of the filtering media and the inherent limitations of conventional filtration resulting from pore clogging or filter cake compression are removed. An investigation of electroosmotic pumping for dewatering sewage sludges to a solids level sufficient for autoincineration has been carried out, and it has been determined that the technique is applicable to sludges of various types. The most efficient dewatering is obtained when solids are collected from a screen cathode. For efficient dewatering from very wet sludge (2%) to burnable solids, it is necessary that an initial sludge film be formed at the cathode surface. Sludges cannot be thickened to a solids content exceeding 20% if the cake is beneath the liquid level of the sludge suspension; for drying beyond the 20% value, and cake must be brought out of the liquid. Preliminary cost estimates indicate that electroosmotic sludge dewatering is a potentially attractive unit process. (Hancuff-Texas)
W70-09752

HINDERED SETTLING AND THICKENING OF CHEMICALLY PRECIPITATED FLOCS,
Technical Coll. of Transport Engineering, Zillina (Czechoslovakia); and Hydraulic Research Inst., Brno (Czechoslovakia).
I. Tesarik, and J. Vostril.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Settling velocity, *Chemical precipitation, *Flocculation, *Mathematical models, *Hydraulics, Turbulence, Fluids friction, Coagulation, Columns.

The problem of settling a layer of a concentrated suspension is rather important in water treatment but extremely difficult to solve. It is generally explained on the basis of Kynch's assumption. The flocs in the layer have various dimensions but, owing to the close packing, they sink at the same velocity. Kynch introduced the assumption that at any point in the dispersion the velocity of fall of a particle depends only on the local concentration of particles. Experiments with hindered settling were performed in a transparent column of internal diameter D=30 cm and total height h=250 cm. The experiments were performed with the chemical treatment of the raw water. Ferric chloride was the basic coagulant. The character of the suspended layer was varied by: (1) Changing the superficial velocity of fluidization (0.8 to 2.0 mm/sec). (2) Changing the water temperature. The Kynch equation u = a/ (M exp. alpha) was found to be applicable for suspensions of chemically precipitated flocs. It was concluded that the model tests of settling should be performed in a vessel of diameter 100 times greater than the floc dimension and the suspension height in the model and prototype should be equal. It was also concluded the relation between the velocity of settling and the total solids according to Kynch's theory is exponential; the exponent alpha is positive; its absolute value rises with the temperature and the coefficient a considerably increases with the content of suspended matters. (Hancuff-Texas)
W70-09753

ORGANIC AND LIQUID RETENTION TIME IN A TRICKLING FILTER FORMULATION,
West Pakistan Univ. of Engineering and Technology, Lahore (Pakistan).
M. I. Sheikh.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 6 fig, 7 ref.

Descriptors: *Trickling filter, *Tracers, *Radioisotopes, *Sewage treatment, Formulation, Retention, Carbon radioisotopes, Depth, Filtration, Design, Pilot plants.
Identifiers: Glucose, Bromide 82.

In spite of its extensive use the design of filters has largely remained emperical and there is no commonly accepted theory of filter performance based on practical and theoretical grounds. Therefore fundamental research was made to study the influence of the many variables affecting the filter process. The investigations were divided into 2 phases: (1) liquid retention time studies on laboratory and pilot scale filters and (2) organic retention time studies on specially built experimental filters. Each pilot filter has an internal diameter of 6 feet and a total height of 11 feet and was operated at hydraulic loadings of 3570 and 140 gal/yd cu/day. The filter medium used was 2 inch stone with specific surface area of 23.8 ft sq/ft cu. The lab scale filters were 6 in. in diameter and 4 feet long, and were fed intermitantly at 5 minute intervals at the same loadings described above. They contained 3/4 inch and 1/4 inch sizes. The filter used for the organic retention time studies was an 18 inch diameter and a 6 foot depth reinforced concrete pipe; and was operated at a loading of 35 gal/yd cu/day. Br 82 was found to be the most suitable of the radio isotope tracers used for measurement of liquid retention time. Median time was found to be inversely proportional to the 0.87 power of the hydraulic surface loading and proportional to the filter depth and specific surface area of the filter medium. Up to 93% of the tracer carbon 14 was removed in about 30 minutes in the first foot of the filter. (Hancuff-Texas)
W70-09754

WASTE TREATMENT OPTIMIZATION BY GEOMETRIC PROGRAMMING,
California Univ., Irvine.
J. Scherfig, R. Schinzinger, and T. W. Morgan.
Fifth International Water Pollution Research Co ference, San Francisco, July 26-August 1, 19 Preprint, 18 p, 17 ref.

Descriptors: *Sewage treatment, *Optimizati *Mathematical models, *Waste water treatme Costs, Construction costs, Activated sludge, Slud disposal, Aeration, Sedimentation.
Identifiers: *Geometric programming, Wet oxi tion.

Geometric programming and two computer gorithms for optimization of waste treatme systems have been described. Mathematical mod of waste treatment systems are classified as: (Convex models; such models can be optimized the convex problem algorithm. (2) Nonconv models with few degrees of difficulty; these mod can be optimized by the search algorithm. (3) No convex models with many degrees of difficul such models cannot be optimized by geometr programming at the present time. A detailed mo of a sludge treatment system including thickeni aerobic digestion, wet oxidation, and ultima disposal is presented and the optimum (i.e. lowe annual cost) design of each unit determined for d ferent constraints. The cost of computer time f optimization is low (less than two minutes to computer time) including compiling for the sludg treatment example and the algorithms are readi adaptable to time sharing, thus geometric pr gramming should become a very significant tool routine engineering design. (Hancuff-Texas)
W70-09755

THE pH TOLERANCE OF ANAEROBI DIGESTION,
New Mexico State Univ., Las Cruces.
R. H. Clark, and R. E. Speece.
Fifth International Water Pollution Research Con ference, San Francisco, July 26-August 1, 197 Preprint, 14 p, 10 fig, 3 tab, 27 ref.

Descriptors: *Hydrogen ion concentration *Digestion, *Anaerobic digestion, Toxicity Methane, Fermentation, Acids, Sludge, Sludg treatment, Sewage treatment, Waste water treat ment, Chemical oxygen demand.

Eight laboratory anaerobic filters constructed from 5.5 in. ID, 36 in. plexiglass columns filled with 1-1 1/2 in. broken quartzite stone media were used t study the effect of non-optimum pH on methane fermentation. The reactor pH, methane produc tion, and effluent Chemical Oxygen Demand (COD) were the primary parameters measured. The pH levels between 3.9 and 9.3 were studied for durations of 12 hours to 21 days. Results showed that: (1) Steady state acetate fermentation at pH levels as low as 4 was possible, although at a rate less than would be attained with the same reactor and bacterial population in the optimum pH range. (2) Acetate fermentation in an anaerobic filter was not inhibited between pH 6 and 8. (3) The recovery of acetate fermentation after a pH drop to as low as 5.0 was complete and prompt if the drop duration was less than 12 hours but required more time than would be expected based on simple bacterial regeneration and was only pH dependent if the drop duration exceeded 3 days. (4) A pH of 9 essentially stopped acetate fermentation, but recovery was complete and prompt after optimum pH levels were restored. (Hancuff-Texas)
W70-09756

SUBSTRATE FLOW IN ANAEROBIC DIGESTION,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, P. G. Thiel, and W. A. Pretorius.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 7 fig, 19 ref.

Descriptors: *Digestion, *Anaerobic digestion, *Anaerobic conditioning, *Sludge treatment, *Flows, Waste water treatment, Sewage treatment,

acteria, Methane, Fermentation, Microorganms.
dentifiers: Cells, Acetic acid.

he optimal utilization of anaerobic digestion is dendent on a knowledge of the mechanism of the rocess, since it forms the basis of kinetic evaluaons of the process. Substrate flow in any biologial treatment process depends on the organisms articipating in the process, and proceeds at two evels namely, flow of substrate in single cells (inacellular substrate flow) and flow of substrate etween cells (intercellular substrate flow). At east three different mechanisms might be involved n methanogenesis during anaerobic digestion. hey are: (1) Single-step methanogenesis in which omplex organics are decomposed directly to ethane, (2) Dual-step methanogenesis in which ntercellular substrate passes through the acidorming and the methanogenic bacterial groups, nd (3) Multi-step methanogenesis in which a symiotic association of two bacterial species exists. he one attacks ethanol producing acetate and H2, hile the other utilizes the H2 together with CO2, o produce CH4. It is concluded that if ethanogenesis requires the activities of more than wo groups of bacteria, another intermediate group f bacteria must exist in anaerobic digestion. The xistence of such a group and its characteristics hould be investigated. It is also concluded that lthough acetate is one of the major precursors of ethane in anaerobic digestion, it is doubtful whether this reaction is 'growth-coupled'. This aspect should be investigated fully, since it is important in kinetic evaluations. (Hancuff-Texas)
W70-09757

KINETICS OF WASTEWATER CHLORINATION IN CONTINUOUS FLOW PROCESSES,
California Univ., Berkeley; and California State Health Dept.
R. E. Selleck, H. F. Collins, and G. White.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 11 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Kinetics, *Chlorination, *Waste water treatment, *Sewage treatment, Flows, Mixing, Coliforms, Mathematical models, Ammonia, Tubes.
Identifiers: Tube reactor, Chlorine demand.

The effect of reactor mixing on the process performance of wastewater chlorination was studied in this investigation for the purpose of obtaining information which can be used to improve the performance of the process as well as to aid in its control. The significance of mixing in terms of process performance is illustrated. In one case an aqueous solution of gaseous chlorine was added to the head of a tubular reactor and in the second case directly to a completely backmixed tank reactor. The residence time in the tubular reactor was only 0.12 minutes while the mean residence time in the backmixed tank was 37.5 minutes. The overkill effected by the two methods of chlorination were radically different. The overkill was more than one order of magnitude greater than chlorine when applied to the tubular reactor. It is concluded from this study that the rate of kill appears to be independent of all factors except amperometric chlorine residual concentration and contact time (and possible temperature). It appears that some bactericidal action takes place as long as any detectable amperometric residual exists in the chlorinated waste water. The results also indicate that the bactericidal potential of the amperometric chlorine residual decreased with time. This indicated that the residual is composed of a number of different species of chlorine compounds which tend to cascade with time toward a less reactive species. (Hancuff-Texas)
W70-09758

KINETIC ASSESSMENT OF GLUCOSE REMOVAL AND SACCHARIDE ACCUMULATION CAPACITIES IN ACTIVATED SLUDGE,
Institute of Chemcial Technology, Prague (Czechoslovakia). Dept. of Water Technology.
M. Dohanyos, P. Grau, and J. Chudoba.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 12 ref.

Descriptors: *Activated sludge, *Kinetics, Sewage treatment , Waste water treatment, Enzymes, Microorganisms, Metabolism, Respiration.
Identifiers: *Glucose removal, *Saccharide accumulation, Sludge age.

Primary substrate removal capacity and primary saccharide accumulation capacity of activated sludge have been defined and their values assessed from glucose removal and cell saccharide build-up kinetic data. Dependence of both capacities on activated sludge age in a range from 1.25 to 30 days has been shown. The capacity ranged from about 20 to 400 ml of glucose (Or COD) per gram of initial activated sludge suspended solids depending on the sludge age and substrate composition. The glucose primary removal capacity (and also the accumulation capacity by analogy) depends also on the glucose proportion in the substrate on which the activated sludge is cultivated and on other components of a di-or, multi-substrate containing glucose as one component. As accompanying components glutamic acid and peptone were used in the study. One of the practical results of this study is a warning that synthetic sewage media based on glucose (and presumably even other saccharides) should not be used to obtain designed data unless this is justified by the actual composition of the waste. However it is felt that the relationships found in this study contribute toward understanding the basic characteristics of biological waste treatment. (Hancuff-Texas)
W70-09759

SURVEY OF SEWAGE UTILIZATION FOR AGRICULTURAL PURPOSES IN ISRAEL,
Israel Water Commission.
A. Feinmesser.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 4 tabs, 10 ref.

Descriptors: *Sewage treatment, *Agriculture, *Irrigation, Oxidation lagoons, Ponds, Oxidation, Crops, Water reuse, Water quality.
Identifiers: *Sewage disposal, Israel.

Discussion is presented on various means of sewage disposal for example: discharge to rivers and streams, discharge to sea, use for irrigation, disposal on dry river beds and treatment for reuse in urban areas. Results of a survey conducted in 267 settlements is tabulated and includes data on population, livestock and industry, quantities of waste sewered, quantities of water purified and the possibilities for reuse of sewage. The potential amount of reusable or usable sewage from the inspected settlements is 65,000 m cu/day. The amount being utilized was 42,000 m cu/day. A survey of urban sector was also conducted and covered 62 municipalities having a total population of 2,100,000. The sewage potential was 343,000 m cu/day. Of this amount about 84% or 287,000 m cu/day were sewered. Approximately 119,000 m cu/day of sewage or 42% of the sewered waste undergoes purification in treatment plants. Only 23% of the total urban sewage potential or 28% of the sewered waste representing 79,000 m cu/day are being utilized at present. Tabulation is presented of the crops irrigated with municipal sewage including the areas irrigated and the quantity of sewage utilized. The mineral concentration and the per capita contribution from towns and agricultural settlements is also tabulated. A short discussion is also presented on oxidation ponds and their increasing use for waste water in Israel. (Hancuff-Texas)
W70-09760

AERATED GRIT CHAMBER WITH TANGENTIAL INLET,
Technical Univ. of Prague (Czechoslovakia).
Z. Konicek, and I. Pardus.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 8 fig, 7 tab, 7 ref.

Descriptors: *Aeration, *Energy, *Bubbles, *Flows, Inlets, Mathematical models, Velocity, Efficiencies, Circulation.
Identifiers: *Grit removal.

Spiral flow in an aerated grit chamber is produced by artificial aeration along its longitudinal wall. Components of both horizontal and cross velocity form a spiral current. The aeration should be strong enough to insure a final water velocity of 25 to 30 cm/sec 5-10 cm above the bottom of the chamber. The detention time at dry weather flow should be at least 1.5 min. The mean horizontal velocity in the grit should not exceed 30 cm/sec and the length of the chamber should correspond at least to a triple spiral. The hydraulic conditions of the chamber may be improved by the addition of a longitudinal baffle placed along the aeration system and the efficiency of the grit chamber can be enhanced by placing the water outlet in the center of the cross-sectional area. In analyzing the optimum conditions for grit removal design an energy balance is utilized and extensive mathematical munipulation are carried out. Results of calculations are compared with results obtained by direct measurement. In the tests made the detention time varied from 3.1 to 9 minutes and in all tests the optimum detention time proved to be approximately 7 minutes. Efficiency tests at different aeration intensities were also made varying the flow from 1.03 to 1.1 m cu/sec. The grit chamber without a baffle indicated the optimum aeration is approximately 40 Ncm cu/hour. (Hancuff-Texas)
W70-09761

THE INFLUENCE OF WASTE WATER CONCENTRATION ON THE ACTIVATED SLUDGE PROCESS EFFICIENCY,
Water Economics Research Inst. Warsaw (Poland).
J. Ganczarzyk, and S. Bachanek.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Activated sludge, *Sewage treatment, Efficiency, Mathematical models, Chemical oxygen demand, Kinetics, Organic loading, *Waste water treatment.
Identifiers: Fiber Board.

Waste water from the production of fiberboard contains a complicated mixture of dissolved and colloidal organic substances which has a range of concentration from 7,300 to 42,000 mg/l COD. These are primarily colloidal carbohydrates and to a lesser extent furfurol, lower alphatic acids, alcohols, aldehydes and ketones. Dissolved oxygen levels of 1 to 2 mg/l were maintained throughout the experiments as well as a constant ratio of mineral nutrients to the BOD load with BOD:N:P equal 100:5:1. The pH was between 7 to 7.5 and the temperature was between 18 deg C and 20 deg C. The dependent variables in each experiment were: the concentration of the influent, suspended solids contained in the aeration tank (3.15 to 11.17 g/l), and the waste water aeration period (2.9 to 123 hours). The experimental results amounting to 660 separate measurements were statistically analyzed with the use of the Least Squares Method and calculated correlation factors were verified by the Students Test. These results were not interpreted either according to the Michaelis-Menten theory nor the two-phase hypothesis, but were generalized on the basis of the equation for a retardant reaction. It was concluded that under some conditions it is possible to use the activated sludge treatment even for very concentrated waste waters. (Hancuff-Texas)
W70-09762

OXYGEN UPTAKE AND MECHANISM OF SUBSTRATE PURIFICATION IN A MODEL TRICKLING FILTER,
Cornell Univ., Ithaca, N.Y.
P. Monadjemi, and V. C. Behn.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 14 fig, 6 ref.

Descriptors: *Trickling filters, *Mathematical models, Depth, *Films, Slime, Dissolved oxygen filtration, Chemical oxygen demand, Sewage treatment, Waste water treatment, Oxygen demand.
Identifiers: *Oxygen uptake, Purification.

A mathematical formulation is presented modeling the activity of the trickling filter. The basic assumptions in the development of this formulation are: (1) the flow of each individual element approximated to be of cylindrical shape is laminar with molecular diffusion as the prevailing means of mass transfer in the liquid layer, (2) at the point of contact of each element with the one immediately above or below it mixing of the liquid occurs, (3) the available active surface of slime film and the quality of it is constant in each element and from element to element for the biochemical oxygenization is not rate determining, (4) the substrate used is in the form of soluble nutrient, (5) the filter elements are packed in cubical fashion, (6) the waste has only one single compound. The mathematical model developed shows that the log of the portion of the substrate remaining is a linear function of depth. The oxygen uptake model is developed based on the same or similar assumptions. A dissolved oxygen profile was obtained using glucose as a substrate. The oxygen uptake in the filter was in the order of 10 mg of O2 per hour per gram of slime film. Calculations for the top sections indicate that the uptake was about 13.6 mg O2 per hour per gram of slime film and for the bottom sections 7.1 mg O2 per hour per gram. (Hancuff-Texas)
W70-09763

SOME FACTORS AFFECTING THE EFFICIENCY OF HIGH-RATE BIOLOGICAL FILTERS,
Water Pollution Research Lab., Stevenage (England).
A. M. Bruce.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Trickling filter, Films, Surfaces, Materials, *Biological treatment, *Filtration, Biochemical oxygen demand, Pilot plants, Sewage treatment.

Observations have been made over a 12 month period of the performances of six pilot scale biological filters containing different types of media. When receiving settled domestic sewage at a rate of 6 m cu/day the BOD removal efficiency of filters containing plastic sheet packings for mineral aggregate medium was related in a fairly consistant manner to the specific surface area provided by the medium. A tubular plastic medium demonstrated a lower efficiency than the other media in relation to the specific surface provided. The effect of temperature on performance was pronounced and the calculated value of the temperature coefficient was much greater than that which has been found in studies elsewhere. In analyzing the seasonal effects due to temperature changes the temperature coefficient C was found to range between 1.1 and 1.035 with a mean 1.21. This value was substantially greater than the value 1.035 normally applied to lightly loaded precolating filters. The temperature range of this study was between 18 deg C to 9 deg C which caused a fivefold change in oxygen uptake or substrate utilization. (Hancuff-Texas)
W70-09764

A MATHEMATICAL MODEL OF SELF-PURIFICATION PROCESS IN A CANALIZED HIGHLY POLLUTED RIVER,
Water Economics Research Inst., Wroclaw (Poland).
H. Manczak, and R. Kransnodebski.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 2 tab, 6 ref.

Descriptors: *Mathematical models, *Rivers, *Self-purification, *Dissolved oxygen, Oxygen sag, *Biochemical oxygen demand, Water pollution, Reaeration, Kinetics.
Identifiers: *Suspended solids.

Results of research on the self-purification capacity of the Odra river along it's course of 264 km are utilized to construct a mathematical model for describing the oxygen sag curve. The research was based on hydrographic, hydrometric and hydronomic measurements. The measurements have been performed during four periods. In winter when the river was covered with ice, in winter when it was free of ice, in summer, and in autumn. The data namely BOD5 and DO obtained from these measurements served as a basis for construction for the mathematical model of the oxygen utilization process and of the dissolved oxygen curve. Three basic assumptions are made in the construction of this model: (1) the changes of pollution of oxygen content in the stream caused by waste water discharge by tributaries or by weirs are stepwise, (2) the changes of the flow of the stream caused by tributaries are stepwise also, (3) the reaeration coefficent is a function of BOD5, (4) in every interval the BOD process in deoxygenization are first order processes and constant. (Hancuff-Texas)
W70-09765

NEW DEVELOPMENTS IN THE DESIGN OF ACTIVATED SLUDGE TANKS WITH LOW B.O.D. LOADINGS,
Dwars, Heederik, and Verhiey Ltd., Amersfoort (Netherlands).
J. Zeper, and A. De Man.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 10 p, 11 fig.

Descriptors: Design, *Activated sludge, *Organic loading, *Biochemical oxygen demand, Energy turbulence, Aeration model studies, Testing, Mathematical models, Efficiency, Prototypes.
Identifiers: Carrousel tank, *Aeration tank.

In the activated sludge tanks the energy needed to keep sludge floc in suspension amounts to 15 to 25 watts/m cu. With BOD loadings below 1 kg/m per day this value often exceeds the energy needed for oxygen transfer. In oxidation ditches with BOD loadings as low as 0.2 kg BOD/m day sludge floc are kept in suspension by the uniform turbulent flow in the ditch. The 5 to 8 watts/m cu needed for oxygen transfer by cage rotors are sufficient to generate suspension turbulence in the ditch. Model tests have shown the feasibility of generating an adequate uniform turbulent flow in oxidation ditches using surface aerators with a vertical axis. The tests on a prototype oxidation ditch with 3,500 m cu liquid content proved the possibility of this arrangement. This new type of activated sludge tank, the Carrousel tank, combines the advantages of high oxygen transfer efficiency and a confined aeration zone adapted to the size of the aerator. With low energy demand for suspension of sludge floc in flow channel within the tank 3 to 5 watts/m cu were found to be sufficient. Design data are given for Carrousel tanks now under construction. Among these are three large oxidation tanks of 19,000 m cu each, as well as an activated sludge plant with 4 tanks of 2,900 m cu each. (Hancuff-Texas)
W70-09766

TURBULENCE DIFFUSIVITY IN ACTIVATED SLUDGE AERATION BASINS,
Utah Water Research Lab., Logan.
A. A. Kalinske.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 3 fig, 24 ref.

Descriptors: *Turbulence, *Diffusivity, *Activat sludge, *Aeration, Waste water treatment, Biolo cal treatment, Energy, Mass transfer, Mathematic model, Kinetics.
Identifiers: Aeration basins, Agitation, Flo Gradients.

In the study of complex turbulence fields in a tivated sludge aeration basins one must consid the parameters which are pertinent to the partic lar process that is being considered. No over general average characterization of the turbulen in such basins is of much value. The customa criteria of energy input (average veloci gradients) as calculated from the power input is n sufficient to characterize the turbulence involvi air bubbles and floc matricies. Of greater ir portance are the turbulence intensities usually e pressed as the mean square velocity function ar the energy dicipating eddies, as shown by a turb lence spectrum. High intensity in small scale eddi of a size comparable to the floc will increase th various process transfer rates by increasing the ap plicable diffusivity and by floc disintegration to e pose as much of the microbial surface as possibl Diffusers are reported to have inherent limits so f as controlling the intensity and scale of the turbu lence are concerned, and mechanical means suc as turbines are suggested to generate high localize fluid shear and large amounts of microturbulence This is considered to be of particular importanc where oxygen enriched air or pure oxygen may b used for treating strong wastes maintaining hig values of DO or using high concentrations o suspensions. (Hancuff-Texas)
W70-09767

GENESEE COUNTY, MICHIGAN PUBLIC WORKS PLAN FOR WATER POLLUTION CONTROL.
Consoer, Townsend and Associates, Flint, Mich.

Engineering report to Genesee County Drain Com missioner, Flint, Michigan, January 1970. 104 p, 30 fig, 3 tab. HUD Project No. P-MICH 3241.

Descriptors: *Sanitary engineering, *Sewers *Sewage treatment, *Long term planning, *Ur banization, *Water resources planning, *Programs *Coordination, *Pollution abatement, *Water pol lution control, *Waste water treatment, Municipal wastes, Construction costs, Operating costs, Pro ject planning.
Identifiers: *Sanitary sewers, Public works planning.

A county-wide public works plan is described for water pollution control in Genesee County, Michigan. The plan for sewers and sewage treatment was initiated by the County Drain Commissioner in anticipation of potential problems from expansion of service areas, relief sewer requirements, flows from outside Genesee County, and overloads on present waste water treatment facilities. The purpose of the plan is to provide a sanitary sewerage system designed to handle ultimate needs when the County and contiguous tributary area attain full development. All existing sewer systems and future construction would ultimately be merged into an integrated system. At present, the City of Flint provides waste water treatment for County flows from one of six County sewage disposal districts. Two alternative plans are presented for sewage disposal. One is to continue the agreement with Flint and participate in plant expansion. The other is to expand the capacity of a county treatment plant and construct the trunk sewer necessary for flow diversion. Descriptions of recommended improvements, expansion and additions to the sewer systems and waste water treatment facilities, together with estimates of construction costs and operating costs, are included. Methods of financing are discussed. (Poertner)
W70-09796

OMMUNITY ACTION PROGRAM FOR
VATER POLLUTION CONTROL.
ational Association of Counties Research Foun-
ation, Washington, D.C.

uly 1967. 182 p, 65 fig, 2 tab, 73 ref. FWPCA
emonstration Grant WPD 55-04-67.

escriptors: *Water pollution control, *Local
overnments, *Programs, *Community develop-
ent, *Urbanization, *Municipal wastes, *Pollu-
on abatement, *Legislation, *Planning, *Financ-
g, *Treatment facilities, *Waste water treatment,
Water quality control, Sewage treatment, *Pro-
ct planning, Administration, Personnel manage-
ent, Training, Compensation, Administrative
gencies, Operation and maintenance, Design,
ewerage, Sewers, Construction.
dentifiers: *Community action programs,
Guidelines, Organization, Implementation pro-
rams.

en community action guides for water pollution
ontrol are presented to provide policy-making of-
icials of local governments with guidelines on all
spects of planning, design, organization, financing
nd operation of programs to prevent and abate
ater pollution. The information was obtained
rom officials in nearly 60 communities with suc-
essful anti-pollution programs. The ten action
uides, each presented as a chapter of the publica-
ion, are: Enabling Legislation for Pollution Con-
rol Programs; Area-wide Approach to Pollution
Control Programs; Planning Pollution Control Pro-
grams; Organization of Pollution Control Pro-
grams; Construction of Collection and Treatment
Facilities; Financing of Pollution Control Pro-
grams; Technical and Financial Assistance Availa-
ble to Localities; Gaining and Maintaining Public
Acceptance for Pollution Control Programs;
Staffing Pollution Control Facilities; and An Action
Plan for Instituting Community Pollution Control
Programs and Bibliography of Pollution Control
Literature. These action guides are designed to be
useful to community leaders, local officials, en-
gineers, managers, finance experts, attorneys and
others who have responsibility for portions of a
total pollution control program. Illustrations and
photographs are included. (Poertner)
W70-09800

RESEARCH AND PRACTICE IN ANIMAL WASTES TREATMENT,
Lilly (Eli) and Co., Lafayette, Ind. Tippecanoe Labs.
Robert H. L. Howe.
Water and Wastes Engineering/Industrial, Vol 6, No 1, January 1969. p A14-A18, 6 fig, 7 tab, 6 ref.

Descriptors: *Animal wastes, *Waste treatment, *Waste water treatment, *Industrial wastes.
Identifiers: *Packing house wastes, Population equivalents.

In recent years, the problem of animal and dairy wastes has grown larger due to increased demands for more effective control of wastes discharges to streams and due to the increased demand for more food to feed our ever growing population. BOD content of various animal wastes were studied and it was found that cattle produce 6.5 lbs BOD/day or 27 times the amount produced by humans, which was found to be 0.17 lbs/day. Hogs produce 0.85 lbs BOD/day and chickens, 0.07 lbs BOD/day. Experience indicates solid and liquid wastes should be handled separately for reasons of economy. Traditional methods of disposal and treatment were observed, and some research was conducted in physical and chemical methods of treatment, especially in the area of coagulation. Animal processing wastes were found to require solids separation and recovery before treatment by conventional means. Listings of the processes used and flow charts are given to illustrate the treatment of the animal processing wastes. It is recommended that further research in treatment and handling of animal wastes, and improvement of efficiency and economy of treatment be made. Segregation of wastes and recovery of by-products are also recommended as ways to increase economy. (Makela-Texas)
W70-09803

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
Charles V. Bibbs, and Stuart M. Alexander.
Water and Wastes Engineering, Vol 6, No 8, August 1969. 66-69 p, 2 fig, 1 tab.

Descriptors: *Automatic control, *Telemetry, *Remote control, Mathematical models, Treatment plant.
Identifiers: *Collection systems, *Interceptions, *Combined sewers, Trunk sewer, Outfalls, Pumping stations, Digital counter.

Combined sewers are designed to utilize the maximum storage during periods of high flow. A computer augmented treatment and disposal system (called CATAD) proposed for the municipality of metropolitan Seattle is described. This program enables the minimization of the overflow of combined sewage. Existing local station controls and the principal objectives of the system controls are outlined. The paper also describes how the desired degree of control is achieved by the new system. Various components of the system and their primary functions are presented. A description of a mathematical model which will automatically control the system is presented. Apart from acting as a control for the combined sewage flow, the system also does recording and storing of water quality data for later analysis. The system has a good capability for future expansion. (Radhakrishnan-Texas)
W70-09804

FEDERAL PROGRAMS STUDY WASTES FROM RAW AGRICULTURAL PRODUCTS,
Agricultural Research Service, Washington, D.C.
Sam R. Hoover.
Industrial Wastes, Vol 116, No 11, November 1969, p 22-25. 2 tab, 4 ref.

Descriptors: *Environment, *Wastes, *Domestic wastes, *Biochemical oxygen demand, *Solid wastes, By-products, Tertiary treatment, Incineration, Water pollution.
Identifiers: *Population equivalent, *Agricultural processing wastes, Molasses, Land disposal, Food processing plants, Salt water intrusion.

The direct and indirect effects of agricultural wastes on pollution of the environment are discussed. Attempts made by various agencies to assess the magnitude of the problem are outlined. Various methods by which pollution from agricultural products can be minimized include food processing methods, methods of harvesting, improved methods of peeling vegetables, efficient separation and removal of solid wastes from processing stream, new processing methods and recovery of by-products. Some of the effects of controlling pollution are also mentioned. Out of the various recommendations made to improve control of agricultural pollution the broad and specific areas where research needs to be done are also pointed out. The main purpose of the research will be to know to what extent the improved methods can minimize pollution from agricultural wastes. Finally the research programs undertaken by the various federal agencies to control pollution arising out of wastes from agricultural products are presented. (Radhakrishnan-Texas)
W70-09805

DISPERSED AIR FLOCCULATION/FLOATATION FOR STRIPPING OF ORGANIC POLLUTANTS FROM EFFLUENTS,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. Van Vuuren, G. J. Stander, M. R. Henzen, S. H. V. Van Blerk, and P. F. Hamman.
Water Research, Vol 2, No 2, February 1968. 177-183 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Sewage effluent, *Dissolved oxygen, *Flocculation, Adhesion, Aeration, Ponds, Lagoons.
Identifiers: *Organic pollutants, *Floatation, *Activators, *Humus tank, Retention period, Maturation pond.

Basic principles underlying dissolved air and dispersed air floatation techniques are discussed. Some methods used by other investigators for dispersed air floatation technique are also presented. A small scale dispersed air floatation unit which was developed for separating organic pollutants from sewage effluents is described. A modified dispersed air generating system was developed by the suction of air into the pump impeller. This technique is advantageous in that it avoids high pressure floatation equipment. The laboratory scale unit was found useful to determine the basic design criteria for similar equipment to be used for a pilot-scale plant. (Radhakrishnan-Texas)
W70-09806

THERMAL TREATMENT OF SEWAGE SLUDGE,
A. Bjorkman.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Based, June 2-5, 1969. N.P., N.D. p 682-686.

Descriptors: *Dehydration, *Incineration, *Sewage, *Sewage sludge, *Sludge treatment, Sludge, Sludge disposal.
Identifiers: *Hygienization, *Thermal treatment, Raw sewage, Chemical-thermal process.

Working Group Six of the 4th International Congress of the IRGR discussed four main issues of sludge treatment: hygienization, dehydration, drying, and incineration of sewage. The necessity for hygienization destroying the pathogenic germs in order that the sludge can be used in agriculture without any danger of infection was discussed. Problems concerned with use of sewage for irrigation were also discussed, for example groundwater pollution and heavy metal accumulation in soil. Thermal treatment for the purpose of dehydrating was evaluated emphasizing the exclusion of soil pollution, using drying beds, digestors or chemical admixtures as advantages. The discussion delt mainly with the problem of what treatment should be applied to the highly polluted effluent of dehydration. Multi-use plants for both drying and incineration were described. (Waid-Texas)
W70-09807

THERMAL TREATMENT OF SEWAGE SLUDGE,
A. Bjorkman.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Bosel, June 2-5, 1969, N.P., N.D., 670-681 p.

Descriptors: *Dehydration, *Incineration, *Sludge, *Sewage, Oxidation, *Sludge treatment, Sludge disposal.
Identifiers: *Hygienization, *Thermal treatment, Raw sewage, Wet incineration, Fluidized bed.

Thermal treatment plays a growing role in the disposal of sewage sludge. It is used to pasteurized sewage for agricultural use. Hygienists recommend a temperature of 70 deg C for 20-25 minutes for pasteurization. Heat and pressure coagulate the solid materials contained in sludge, destroy the cell walls and release the strong binding of sludge water to solid materials. Treatment at 200 deg C and under 15 atmospheres pressure allows mechanical dehydration processes to obtain residual water content of 40-44%. Heat treatment is also applied in several drying processes such as multiple hearth dryers, drying drums, flash drying systems or a belt dryer. If the sewage cannot be used it can be incinerated and the smallest possible residues then disposed of. Fluidized bed incineration and wet incineration are described. Liquid or dehydrated sludge can also be incinerated in appropriate devices jointly with good results. (Waid-Texas)

W70-09808

REUSE OF INDUSTRIAL COOLING WATER,
Water Service Labs., Inc., New York.
Sidney Sussman.
Water and Wastes Engineering, Vol 6, No 1, Jan 1969. p A6-A10, 2 fig, 2 tab, 5 ref.

Descriptors: *Cooling water, *Water reuse, *Cooling towers, Cooling, Water conservation, Corrosion control, Alkalinity, Evaporation.
Identifiers: Blowdown.

Industrial cooling is both one of the largest uses of water and one of the largest examples of water reuse. In 1964, water withdrawal for industrial cooling in the U.S. was estimated at 44.7 trillion gallons. Of this amount, 99% was used in once through cooling, and only 500 billion gallons was used as makeup for recirculating cooling systems in which the water was reused repeatedly. Due to the tremendous volume of water used, only the most essential, very minimum, and least expensive treatment is given the water. This may include straining, sedimentation, chlorination, and corrosion control. In water short areas, secondary effluent from municipal waste water treatment plants can be effectively used for makeup water source. Both closed and open cooling systems are employed. Open systems include cooling towers, evaporative condensers, and evaporative coolers. Evaporative coolers work on the principle of removal of heat as latent heat of evaporation. Use of evaporative coolers can reduce water intake as much as 98% over once thru cooling systems. Problems occur due to chemical composition changes in cooling water from evaporation and exposure to air. Evaporation of water results in an increase in dissolved solids concentration which results in scale formation. Exposure to air results in an equilibrium between gases in the air and the water. (Waid-Texas)
W70-09809

BIODEGRADATION OF SURFACTANT BENZENE RINGS IN SHAKE CULTURES,
Monsanto Co., St. Louis, Mo. Inorganic Chemicals Div.
R. D. Swisher.
Developments in Industrial Microbiology, Vol 9, 1968. 270-279 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Biodegradation, *Surfactant, *Microorganisms, Degradation (Decomposition).
Identifiers: *Benzene ring, *Shake-culture, *Ultraviolet analysis, *Acclimation, Biodegradation, Pathways, Interference, Deacclimation, Cross acclimation.

The work is undertaken to determine whether ring degradation could be achieved under milder conditions characteristics of the shake culture biodegradation test methods. Two pure isomers representative of the components of linear alkylbenzene sulfonate (LAS) were studied, the 3-phenyl and 6 phenyldodecane sulfonates conditions of the standard shake culture biodegradation test method using a culture already acclimated to mixed LAS, were modified to permit (a) use of the characteristic 193 and 223 mu ultraviolet absorption bands for detection of the benzene rings (b) acclimation of the cultures to accomplish ring degradation. After full acclimation the extent of ring degradation of both isomers was at least 80% and may have been 100%; spectroscopic interferences preclude calculation of the exact value. Acclimation to 6 phenyl ring degradation includes acclimation to the 3-phenyl isomer also, but not vice versa. This suggests that the biodegradation pathways may be significantly different for the two isomers. Interference by nitrate in biodegradation of benzene, toulene, etc. characterized by development of strong absorption below about 240 mu in the control culture is also noted. Acclimation rates, ring degradation rates, cross acclimation effects were analyzed. (Shankar-Texas)
W70-09810

PRETREATMENT OF SEWAGE SLUDGE,
Technische Hochschule, Aachen (West Germany). Institut fuer Siedlungswasserwirtshaft.
B. Boehnke.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Bosel, June 2-5, 1969. N.P., N.D., p 615 - 631.

Descriptors: *Sludge, *Stabilization, *Operations, *Sewage sludge, *Pretreatment, *Cost, Vacuum drying, Filtration, Lagoons, Drying, Dewatering.
Identifiers: *Sludge thickening, Drying beds, Vacuum-filtration, Pressure filtration, Conveyor screen press.

A summary of the meetings and discussions of the working group 5 of the 4th International Congress of the IRGR is presented. The theme is discussed under eight sections, namely: (1) criteria for the degree of aerobic and anaerobic sludge stabilization. (2) Operational experience and cost of the following: (a) aerobic and anaerobic sludge stabilization, (b) sludge thickening, (c) centrifugation while considering pre-conditioning, (d) sludge processing in drying beds and sludge lagoons, (e) vacuum filtration while considering pre-conditioning, (f) pressure filtration while considering pre-conditioning, and (g) sludge dewatering through conveyor screen presser. Based on the above studies is concluded that there is no ideal process for sludge treatment but an adequate solution can be found for every particular case. The choice of treatment depends on the sewage plant and partly on the possibilities available for final sludge disposal. The choice of the process depends also on the objective assigned to the particular treatment stage. Cost figures are given for some of the processes. Since it is difficult to say with certainty the most economical combination of two or more processes, it is advisable to make tests. Much progress has been made in the different processes mainly due to high molecular weight flocculants. (Shankar-Texas)
W70-09811

PERFORMANCE OF (ACTIVATED SLUDGE) SECONDARY SEDIMENTATION BASINS,
Peter Pflanz.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 15 p, 7 fig, 2 tab, 10 ref.

Descriptors: *Settling basin, *Activated sludge, *Effluent, Biochemical oxygen demand, Aeration, Efficiencies.
Identifiers: *Aeration tank, Detention time, Solids concentration, Sludge volume index, Suspended solids.

Tests conducted at Hannover in various activated sludge plants are discussed with a view to determining the relationship between solids concentration of activated sludge, detention time and suspended solids in the effluent from secondary sedimentation. A description of the plants studied is presented. The sedimentation rate of the activated sludge is dependent upon a series of factors, the most important being the dry solids matter content of the sludge. The sedimentation process in the secondary basin is demonstrated with solids profiles. Tests showed that an increase in the solids content in the effluent is followed by an increase in the BOD. The relationship between BOD and suspended solids in the effluent varies for different plants. A useful criterion for dimensioning secondary settling basins is the product of the overflow rate and the suspended solids content of the mixed liquor. With readily setteable sludges (SVI=100 ml/g) the maximum solids feed can be as high as 3.5 kg SS/m sq hr. At a SVI of 200 ml/g the maximum solids feed decreases to approximately 1.1-1.3 kg SS/m sq hr. When the sludge volume index is increased to 300 ml/g a maximum solids feed of 0.8-1.1 kg SS/m sq hr must be considered in a secondary basin, if the solids content in the effluent is not to exceed 30 mg/1. (Shankar-Texas)
W70-09812

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Ge many).
W. Niemitz.
Fourth International Congress of the Internationa Research Group on Refuse Disposal, Basel, June 2 5, 1969, N.P., N.D., p 425-435.

Descriptors: *Sludge, *Sludge disposal, Industri waste, Aerobic treatment, Anaerobic treatmen Digestion, Dewatering, Neutralization, Pre-trea ment (Water), Sedimentation.
Identifiers: *Industrial sludge, Petrificatio Polyelectrolytes, Composting.

A definition of 'industrial sludge' was presente through its characteristics which are generally: (1 a tremendous variability as to types of sludge produced in the various industries and, (2) th composition of a specific sludge is usually mor homogeneous than in domestic sludge. In order t further define 'industrial sludge' a summary of es sential specific and general facts and findings al ready fully acknowledged were listed and include (1) processing and disposal methods should be a flexible as possible and include efforts to re-use waste materials, (2) possibilities of joint processing and disposal of industrial and municipal refuse should be studied, (3) sludge should not only be de watered as far as possible but also be stabalize biologically, before any disposal. (Waid-Texas)
W70-09813

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Ger many).
W. Niemitz.
Fourth International Congress of the International Research Group on Refuse Disposal, Basel, June 2- 5, 1969. N.P., N.D., p 436-443.

Descriptors: *Lagoons, *Sludge disposal, Ground- water, Incineration, Industrial waste, Standards, Sewage, Sludge, Dewatering.
Identifiers: *Standardization, *Pre-treatment, *Compost, *Wet-air oxidation, Refuse disposal, Model sludges.

The conclusions of the lectures and discussions of working group two of the fourth Congress of the IRGR are presented. A complex account of the variety of possibilities to characterize industrial sludges were given with respect to pre-treatment and disposal. It was concluded that standardization was necessary to calibrate research methods and give comparable data. This idea was supplimented by a presentation on the usefulness of calibration sludges or model sludges in paper production. The suitability of lagoons for the treatment of sludges was surveyed and the need to take into account the different functions possible for successful operations was emphasized. The immediate spreading of sludges over suitable areas after insuring no soil damage or groundwater pollution was discussed. The working group also discussed several methods of sludge disposal and in general concluded that research should be intensified and that considerable improvement be made in the exchange of information of the research groups concerned. (Waid-Texas)
W70-09814

FLUIDIZATION OF FLOCS PRODUCED IN CHEMICAL OR BIOLOGICAL TREATMENT PLANTS,
Centre Belge d'Etude et de Documentation des Eaux, Liege; Technical Coll. of Transport Engineering, Zillina (Czechoslovakia); and Hydraulic Research Inst., Brno (Czechoslovakia).
F. Edeline, I. Tesarik, and J. Vostrcil.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 9 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Activated sludge, *Sedimentation, *Biological treatment, Settling velocity, Waste water treatment, Reynolds number.

entifiers: *Fluidization, *Clarification, *Flocs, spension density.

is claimed that upflow clarification results in gher efficiencies for the same clarification surce when compared with conventional sedimentaon. The advantages may be a better removal of spended matter, or a higher permissible flow per it area or both. Theoretical relationships pertaing to this phenomenon for flocculated matter and r living flocs from activated sludge are veloped. General theory relative to fluidization particles is discussed. Classical formula for idization of particles is assumed to be valid for cs in the region of Reynold's numbers between 30. Experiments with the fluidization of a layer of cs produced by chemical treatment were perrmed in a cylindrical transparent model presenting the clarifier produced by the ralovopolska factory in Brno, Czechoslovakia. om the results, the relation between volume conentration and suspension densities are established. omparison between fluidization and sedimentaon velocities for the same suspension show that e agreement is fair, with settling velocity slightly wer than fluidization velocity. The same is true r biological flocs in activated sludge. The descripon of physical properties of the fluidization rocess by these formulae yields coefficients which ay be helpful in appreciating qualities of the flocs rmed either chemically or biologically. (Shankarexas)
W70-09815

MODIFIED FILTER MEDIA FOR REMOVAL OF WATER POLLUTANTS,
ndian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
. D. Agrawal, and A. V. S. Prabhakara Rao.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 9 p, 5 fig, 10 ref.

Descriptors: *Filter, *Filtration, Coagulation, Efficiency, Head loss, Turbidity, Waste water treatment.
Identifiers: *Electro-Kinetic force, Surface Potential, Filter media, Bauxite media.

The development of a simple filter with modified media for efficient removals of micro sized particles is discussed. The efficiencies of filtration can be significantly improved by suitably altering the surface properties of media with more desirable surface potentials. Higher filtration efficiencies were obtained when filter media were coated with cationic polyelectrolytes to give a positively changed media, to effectively remove and retain the negatively charged particles. With such filters advance coagulation with alum or ferric chloride can be obviated and the process thus simplified. Further the head loss build up on such a filter is much slower and the removals are more uniformly distributed through the bed. The results of investigation of alternative filter media and coatings to form a positively charged layer on sand to give efficient filtration of natural waters without any pretreatment are discussed. Less than 10 mg/l. turbidity could be produced by filtration of raw stream water or pond water, through crushed bauxite or sand coated with Al2SO3 or Fe2O3. (Shankar-Texas)
W70-09816

TREATMENT OF WASTE WATERS FROM KRAFT-CELLULOSE FACTORIES,
Institute of Hydrotechnical Research, Bucharest (Rumania).
A. Munteanu, E. Cute, and C. Negulescu.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 10 p, 10 fig, 12 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Sludge treatment, Organic loading, Efficiency, Foaming, Biochemical oxygen demand, Phenol, Aeration.
Identifiers: *Pilot plant, *Mechanical treatment, Settling tanks, Hydraulic loading, Aeration channels, Drying beds.

A semi industrial pilot plant was built to test the treatment of waste waters from kraft-cellulose factories and to determine the parameters useful for plant design. Investigations were carried out over a period of 250 days using mechanical treatment, biological treatment and sludge treatment. Two types of settling tanks were used in the investigation using mechanical treatment. It was concluded that upward flow settling tanks allow hydraulic loadings twice as great as those in radial flow tanks with the same treatment efficiency. However, the use of upward flow settling tanks is not recommended due to a strong foaming tendency. The sludge from mechanical treatment does not readily undergo bacterial decomposition. The biological treatment of the waste water was tested using small scale aeration tank with air injected at reduced pressure. The waste water after settlement easily responded to biological treatment provided it was furnished with mineral requirements for bacterial growth. The treatment by activated sludge gives satisfactory results at short aeration periods when partial treatment of the wastes is required and it was found that phenol in the waste water could be removed completely by this method. (Shankar-Texas)
W70-09817

ACTIVATED SLUDGE PROCESS MODIFICATION FOR NITROGEN-DEFICIENT WASTES,
Oklahoma State Univ., Stillwater, and Nalco Chemical Co., Chicago, Ill.
A. F. Gaudy, Jr., K. C. Goel, and A. J. Freedman.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 11 p, 8 fig, 1 tab, 4 ref.

Descriptors: *Activated sludge, *Chemical oxygen demand, *Biochemical oxygen demand, *Nitrogen aeration, Operations, Waste water treatment.
Identifiers: *Nitrogen-deficient wastes, *Operational feasibility, *Sugar refinery, Mechanical feasibility, Detention time, Endogenous-aerator, Plug flow.

The mechanistic feasibility of activated sludge process using whole waste and the operational feasibility of the process under conditions of continuous waste flow is investigated. A nitrogen deficient industrial waste was selected for use in this research and it consisted of sugar refinery effluent. a large fraction of soluble organic matter in the sugar refinery waste was assimilated by the sludge in the absence of an exongenous nitrogen source. The sludge thus synthesized readily settled under quiescent conditions and the supernanant contained relatively small amounts of organic matter A significant portion of the cell constituents of the settled sludge, (converted to protein in the endogenous aeration phase in the presence of extracellular nitrogen) regenerated the COD removal efficiency of the sludge. This was exhibited by its nitrogen retention ability upon recycling to the feeding aerator. The process was operated successfully at a detention time of 5 hours, a COD: N ratio of 60:1 and COD: P ratio of 140:1. COD of the sugar refinery waste varied widely during the study. It was felt that aeration solids levels employed in these studies could be treated successfully with pH adjustments or control. It appears that the process will give good results on wastes which are not purely carbohydrate in nature, and may thus find wide applicability for nitrogen deficient industrial wastes. (Shankar-Texas)
W70-09818

INVESTIGATION OF THE USE OF HIGH PURITY OXYGEN AERATION IN THE CONVENTIONAL ACTIVATED SLUDGE PROCESS,
Union Carbide Corp., Tonawanda, N.Y. Linde Div.
J. G. Albertsson, J. R. McWhirter, E. K. Robinson, and N. P. Vahldieck.
Available from the NTIS as PB-194 241, $3.00 in paper copy, $0.65 in microfiche. Federal Water Quality Administration Water Pollution Control Research Series, May 1970. 186 p, 29 fig, 62 tab, append. FWQA Project 17050DNW--5/70.

Descriptors: *Sewage treatment, *Activated sludge, *Oxygenation, Aerobic treatment, Sludge digestion, Sludge treatment, Oxidation.
Identifiers: Sludge oxygenation.

A full scale system designed to demonstrate the practical and economical use of high purity oxygen gas in aeration of the conventional activated sludge waste treatment process was tested under a variety of operating conditions in a direct performance comparison with a parallel air aerated system. A sparged-turbine, gas-liquid contacting unit was employed in covered tanks of conventional design with liquid and gas staging for cocurrent flow of each phase. This oxygenation system required very low power input for oxygen transfer and liquid mixing. The oxygenation system could operate with MLVSS concentrations of as high as 4500 mg/liter achieving about 90% BOD removals at aeration detention times as low as 1.2 hours (raw flow + recycle flow) treating domestic waste of 220 mg/liter BOD. Biomass from the oxygenation system is highly flocculent and readily settleable with desirable handling characteristics. Recycle and waste activated sludge suspended solids concentrations of about 3% were achieved. Process advantages recognized with the oxygenation system indicate significant reductions in secondary waste treatment costs in comparison to conventional diffused air aerated systems. (Knapp-USGS)
W70-09833

THE FATE OF NITROGENOUS COMPOUNDS THROUGH SEWAGE TREATMENT PLANTS,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
Nava Narkis.
Washington Univ, St Louis, Missouri, Center for the Biology of Natural Systems, Environmental Field Program, February 1970. 52 p, 1 fig, 18 tab.

Descriptors: *Nitrogen compounds, *Sewage treatment, *Domestic wastes, Chemical analysis, Effluents, Trickling filters, Hydrolysis, Biological treatment, Activated sludge, Tertiary treatment, Ion exchange, Electrochemistry, Reverse osmosis, Electrodialysis, Distillation, Nitrification, Denitrification, Septic tanks, Oxidation lagoons, Land application, Bacteria, Algae, Symbiosis, Public health, Chlorine, Corrosion.
Identifiers: *Literature survey, Primary sewage treatment, Secondary sewage treatment, Physicochemical methods, Ammonia stripping, Guggenheim process.

Literature concerning nitrogenous compounds in sewage treatment plants is reviewed, especially emphasizing the modification or replacement of classical treatment operations to remove dissolved inorganic materials more efficiently. In primary treatment, nitrogen removal is low and sedimentation of suspended solids is the only physical process contributing to its total reduction. Returning supernatant liquor from sludge digesters to primary clarifier decreases nitrogen removal efficiencies. Clarified waste water from primary treatment may receive secondary treatment, normally a biological process, designed principally to reduce amount of suspended solids, oxygen demanding material and bacteria. Activated sludge and trickling filters remove 20% to 50% of the incoming nitrogen. Effluents from trickling filters contain high organic and ammonia nitrogen as well as nitrates and nitrites. It is possible to operate activated sludge processes to effect high nitrate concentrations, while ammonia nitrite and organic nitrogen concentrations are minimal. In the tertiary treatment, among the physicochemical methods for removing nitrogenous compounds from effluents, ion exchange and ammonia stripping are the only suitable methods presently efficient. Nitrogen removal by microbial denitrification seems economically

feasible. Septic tank effluents are analyzed. Stabilization ponds do not remove nitrogen compounds adequately. (Jones-Wisconsin)
W70-09907

HYDROLYSIS OF ACTIVATED SLUDGE,
Snell (Foster D.), Inc., Florham Park, N.J.
R. J. Bouthilet, and R. B. Dean.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 13 p, 15 fig, 9 ref.

Descriptors: *Activated sludge, *Sewage treatment, *Hydrolysis, Waste water treatment, Fertilizers, Filtration, Nutrients, Waste disposal, Biological treatment, Sludge.
Identifiers: *Refractory organics, *Biological solids.

Of concern in sewage disposal plants is the disposal of the solids which accumulate as a result of various separation procedures. Of particular concern is the disposal of activated sludge which is the solids residue resulting from aerobic digestion of soluble or non settleable solids in sewage. Various processes have been suggested to aid the thickening and clarification of these aerobic residues. These include addition of chemical coagulants and precipitants such as ferric chloride, polyelectrolytes, lime, alum, and others. Other treatments have evolved which involved conditioning the settled sludge before filtration. An improved process for the treatment of activated sludge has been developed. The process consists of heating of activated organic sludge in the presence of water and small amounts of sulphur dioxide. This treatment increases soluable solids, improves filtration efficiency by a factor of 100 and reduces the moisture conttne of the resultant filter cake. Concentration of the filtrate produced a molasses type syrup which from amino acid analysis and rat feeding studies could be of value as an animal feed. The cost of digesting 25,000 pounds of solids yielding a syrup containing 20% solids will be $160.69. Evaporation to molasses will cost $244. (Hancuff-Texas)
W70-09934

SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
R. I. Dick.
Journal Water Pollution Control Federation, Vol 42, No 6, p 934-949, June 1970. 119 ref.

Descriptors: *Sludge, *Sludge treatment, *Sludge disposal, Sludge digestion, Dewatering, Incineration, Ultimate disposal, Fertilizer, Sewage treatment, Waste water treatment.
Identifiers: Characterization, Conditioning, Thickening.

Studies have been made to determine the optimum solution of the total waste treatment problem which includes socioeconomic evaluation and technical feasibilities. The treatability of sludges produced from advanced waste treatment largely have been ignored, and the sludges produced by the removal of phosphates through the precipitation with lime have created some difficult problems. The results of many investigators' studies on conditioning of sludge prior to dewatering is outlined. The use of polyelectrolytes quar gum, alum, flyash, lime and a variety of other sludge conditioners are discussed. Prethickening, freezing and thawing, and paramagnetic separation are a few newly proposed sludge conditoning processes. Gravity and flotation thickening are discussed in some detail and several pilot plant and full-scale process results are presented. In the discussion of sludge dewatering, several processes are evaluated: sand drying beds, vacuum filtration, centrifugation and mechanical gravity dewatering units. The calorific value of sludges is discussed in regard to sludge incineration and the recalcination processes for lime recovery evaluated. Many suggestions are presented for the ultimate disposal of sludge, including because of its commercial fertilizer value irrigation. (Hancuff-Texas)
W70-09935

IMPLICATIONS OF MICROBIAL POLYMER SYNTHESIS IN WASTE TREATMENT AND LAKE EUTROPHICATION,
Ohio State Univ., Columbus.
P. R. Dugan, R. M. Pfister, and J. I. Frea.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint, 10 p, 9 fig, 13 ref.

Descriptors: *Nitrification, *Microbiology, *Waste water treatment, Sewage treatment, Synthesis, Aerobic, Treatment, Biological treatment, Metabolism, Adsorption, Flocculation, Natural streams, Lakes.
Identifiers: *Polymers, Cells, Natural waters.

The aggregation or flocculation of the biomass formed by microbial metabolic reactions results in settling and thereby provides a means for mechanically separating cells from supernatant. These processes are complicated by adsorption on suspended particles of inorganics as well as organics that are not readily oxidized. Adsorption is a physical-chemical phenomenon but the biological formation of adsorption sites on sludge floc also relegates this to a consideration which overlaps biology. The group of bacteria historically recognized as primary contributors to aerobic waste treatment were studied. All the floc forming bacteria have been observed to produce extra cellular polymer fibrils. The physical and chemical properties of these fibrils around different species of bacteria will determine the extent to which water is bound to the polymer and also determine solubility properties of the polymer and affinity for adsorption of dissolved chemicals. A discussion is presented on the relationship of ion adsorption to polymers and its relationship to waste treatment nitrification. The interactions among floc forming microorganisms found in natural waters, suspended solids, dissolved chemical and other particulates are similar to those observed in waste treatment systems. (Hancuff-Texas)
W70-09936

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMICA BAY,
Rand Corp.
J. J. Leendertse.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 2 fig, 4 ref.

Descriptors: *Computers, *Programme, *Simulation analysis, Ecology, Environment, Mass transfer, Mathematical model, Flows, Water pollution, New York.
Identifiers: *Marine disposal, *Jamica Bay (New York), Grids.

The study of technical solutions to the problem of managing fluid waste discharges in an estuary involves complicated relationships, such as those between waste load, location of discharges, degree of treatment, geometry of the estuary, flow in the estuary, and temperature. Models can be built to predict the probable consequences of each of the alternative solutions chosen. Such a model is being used and evaluated in a study of the extent and control of pollution in Jamica Bay, New York. A model of the fluid waste discharge establishes the relationship between the transport of pollution and the transporting medium. A reaction model is designed to describe the chemical and biochemical transformations. In the flow model velocities of the water in the region are computed together with the water levels. Because the tide state influences the location of the waters edge on the tidal flats, which effects surface area and cross sections to a considerable extent, such functional relationships are included in the model. The flow in the estuary is governed by the shape of the estuary and its boundaries at the sea and inland ends as well as by the tides and river discharges. The fluid waste loads in the system influence the pollution constituent transport while air temperatures, solar radiat and exchange of gases at the water surface fluence the reactions. (Hancuff-Texas)
W70-09937

TREATMENT-COST RELATIONSHIPS F ORGANIC INDUSTRIAL WASTES,
National Inst. for Water Research, Pretoria (So Africa); and Texas Univ., Austin.
J. L. Barnard, and W. W. Eckenfelder, Jr.
Fifth International Water Pollution Research C ference, San Francisco, July 26-August 1, 19 Preprint, 19 p, 5 fig, 7 tab, 7 ref.

Descriptors: *Industrial wastes, *Waste wa treatment, *Costs, *Mathematical model, Was Water quality, Biological treatment, Organic lo ing.
Identifiers: Parameters, Characteristics.

The coming decade will see a large number plants constructed for the treatment of orga waste waters. These plants may treat industr wastes alone or industrial wastes in combinat with domestic sewage. Various process combi tions can be employed to yield specific efflu qualities. Depending on the desired effluent qua and the characteristics of the waste water c process combination will prove the most econo cal. A treatment process sequence was selected waste waters from the organic chemical indus and for various combinations of domestic and dustrial waste water. Each treatment sequence w designed for a range of waste characteristics a treatment parameters and the total plant cost w developed. Cost models were then generated whi described the influence of the various paramet on the total cost. This serves to illustrate the ecor my of scale and the significance of the vario parameters on cost. The sensitivity of the capi cost to change in the waste parameters is shown. the development of the cost models wide variatio of design parameters were incorporated. For the i dustrial model BOD was varied from 200 to 3,0 mg/l, suspended solids from 0 to 500 mg/l and from 0.0001 to 0.0007 l/mg per hour. For the co bined treatment model BOD and suspended soli varied from 200 to 800 mg/l and K from 0.0001 0.00013 l/mg per hour. (Hancuff-Texas)
W70-09938

MARINE WASTE DISPOSAL IN GHAN WATER QUALITY EVALUATION,
University of Science and Technology, Kuma (Ghana).
C. K. Annan, and A. M. Wright.
Fifth International Water Pollution Research Co ference, San Francisco, July 26-August 1, 197 Preprint. 7 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Sewage, *Monitering, *Water qua ty, *Evaluation, Chemical properties, Biologic properties, Physical properties, Bacteria, Sewag treatment, Analysis.
Identifiers: *Marine disposal, Ghana.

Special studies on the aspects of water quality wer made to plan the most appropriate marine wast disposal system which would provide adequate pro tection for the beneficial uses of the coastal wate The significant findings of this study were as fo lows: (1) the strength of the sewage from th Accra-Tema Metropolitan Area is expected to b medium strength, that is, a BOD of 280 mg/l an total suspended solids of 219 mg/l. (2) The greas content of the sewage is expected to be relativel high in comparison with urban wastes of the Unite States, i.e. 110 mg/l. (3) the bacterial dieaway rat in the receiving waters is high (T sub 90 of 8 minutes). (4) strong Guinea currents exist on th coast. These currents are predominately parallel t the shore line, (5) except in areas of direct pollu tion the beach waters in the study area were foun to be relatively free of coliform organisms. It is an ticipated that the strong Guinea currents woul transport the wastes away from the discharge loca tions generally parallel to the shore line. This facto

coupled with the high coliform bacteria die-off rate implied that appropriately treated sewage could be discharged safely through a well designed marine outfall system. (Hancuff-Texas)
W70-09939

PROPOSED PLANS FOR SEWAGE DISCHARGE FROM THE GOTHENBERG REGION, SWEDEN,
Goteborg Water and Sewage Authority (Sweden).
E. Rindergard, and S. Hallquist.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 8 p, 3 fig, 2 tab.

Descriptors: *Sewage disposal, *Sewage treatment, *Planning, Waste water treatment, Alternative costs, Water pollution, Costs.
Identifiers: *Gothenburg (Sweden), Outfall, Study.

Gothenburg is the second city of Sweden and is situated on its western coast. Its population is now about 450,000, and it is estimated the total population will be 750,000 in the year 2000. The river Gota Alv flows through Gothenburg. The main pollutant in the river are (1) suspended solids, 50,000 tons/yr inorganic (clay) and 20,000 tons/yr organic matter (2) industrial waste mainly from paper mills but also from metal and chemical factories, and (3) bacteria. There are no problems affecting the dissolved oxygen and BOD of the river water. The amount of suspended solids in the sewage from the city is equivilant to roughly 10,000 tons/yr. The equivilant of about 400 tons/yr of P enters the river with the sewage and increases the P content to approximately 0.06 ppm. The proposed sewerage system consists of construction of intercepting pipelines and rock tunnels by which all sewage from the city can be conveyed to a site where a treatment plant is to be built. After treatment the sewage could be discharged either into the mouth of the river or into the sea beyond an archipelago which lies just off of the coast. In order to compare conditions at alternative points an extensive investigation has been undertaken. Discharges of the sewage into the sea outside the archipelago, whether after primary treatment alone or with high rate biological treatment, seems to offer an acceptable solution. (Hancuff-Texas)
W70-09942

REMOVAL OF FLUORINE AND ARSENIC FROM THE WASTE WATER OF THE RARE-EARTH INDUSTRY,
State Research Inst. for Rare Metals, Moscow (USSR).
T. Skripach, V. Kagan, M. Romanov, L. Kamen, and A. Semina.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 12 fig, 1 tab.

Descriptors: *Fluoride, *Arsenic compound, *Waste water treatment, *Industrial wastes, Iron, Chemical precipitation, Efficiency, Mixing, Flocculation, Sedimentation, Oxidation.
Identifiers: *Rare-Earth metals, Agitation.

The removal of fluorine from industrial waste waters is accomplished through the use of calcium oxide. The reagent consumption was 200% of the amount required stoichiometrically. The agitation time required without heating is 45 minutes. Results show the fluorine content of the purified water is from 15 to 20 mg/l. Final polishing for the removal of small amounts of fluorine should be made with super phosphate and calcium oxide, or aluminum sulfide. The feasibility of using ion exchange resins and membranes for the removal of fluorine has been shown. The removal of arsenic from industrial waste waters can also be effected with calcium oxide. Iron must be present in an amount which assures total removal of arsenic compounds. If iron salts are not present a special treatment process is required and the description of the treatment is presented. (Hancuff-Texas)
W70-09943

POLYMER PARTICLE REMOVAL FROM LIQUID EFFLUENTS,
V. A. Prokhorova.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 2 fig, 5 tab, 12 ref.

Descriptors: *Effluents, *Coagulation, Chemical precipitation, Colloids, Stabilization, Waste water treatment, Biological treatment.
Identifiers: *Polymers, *Particles, *Removals, Chemical composition.

Suspension, polymerization and copolymerization of styrene using a stabilizer, a suspension of polyvinyl alcohol containing 10 to 21% acetate groups, yields liquid effluents which are stable colloidal systems from the point of view of sedimentation and aggregation and which cannot be treated biologically without pre-treatment. The precipitation and coagulation treatment for the removal of polyvinyl alcohol was studied using alum and magnesium chloride. The results show that magnesium chloride coagulation was much more advantangeous. The following would be essential advantages over the commonly used alum: (1) coagulant consumption is reduced 6 to 7 times, (2) caustic soda consumptions is reduced 2 to 3 times, (3) volume precipated is reduced 5 to 7 times, and (4) the rate of precitation of suspended matter is increased 22 times. The experiments also showed that the pretreated effluents can be treated biologically without dilution. Chemical oxygen demand after chemical treatment ranged from 470 to 2,200 mg/l. Biological oxygen demand after biological treatment was 14 mg/l. As a result of biological treatment the effluents lost their specific sharp odor. (Hancuff-Texas)
W70-09945

APPLIED RESEARCH ON MARINE SEWAGE DISPOSAL FROM THE GOTHENBURG REGION, SWEDEN,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 05B.
W70-09947

BIOLOGICAL FILTERS, (LITERATURE REVIEW),
R. L. Bunch.
Journal Water Pollution Control Federation, Vol 42, No 6, p 895-897, June 1970, 24 ref.

Descriptors: *Trickling filter, *Biological treatment, *Waste water treatment, Filters, Filtration, Costs, Operations, Design, Sewage treatment, Mathematical model, Nutrients.
Identifiers: Variables.

A review of the 1969 literature on biological treatment through the use of trickling filters is presented. A variety of studies have been made on the design, mathematical modeling, industrial applications, and dynamic optimization of these filters. Several studies were performed on evaluating media and the effect of recirculation on efficiency. A large number of cost analyses were made; one summarizes the findings from 1500 waste water treatment plants. Two studies relating to nutrient removal were reported. Because the rotating biological discs method of treating wastes is related to trickling filters it was included in this topic. The variables investigated were hydraulic loading, organic loading, disc speed rotation and dissolved oxygen content of the mixed liquor. (Hancuff-Texas)
W70-09948

OXIDATION OF AQUEOUS SULFIDE BY O2: I. GENERAL CHARACTERISTICS AND CATALYTIC INFLUENCES,
Harvard Univ., Cambridge, Mass.
K. Y. Chen, and J. C. Morris.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 17 p, 12 fig, 1 tab, 15 ref.

Descriptors: *Oxidation, *Sulfides, *Oxygen, *Catalysts, Alkaline waters, Test procedures, Hydrogen, Ion concentration, Kinetics.
Identifiers: Stoichiometry, Experiments.

This survey of kinetic patterns and external influences in the oxidation of aqueous sulfide by oxygen has served primarily to show the extreme complexity of the oxidation and the numerous types of outside factors that can speed up or retard the rate. The variation of the initial rate of reaction with respect to sulfide were conducted varying the sulfide concentration and the oxygen concentration. The influences of pH on the reaction rate are also discussed. No definitive or even tentative mechanism can be proposed on the basis of the current results but the data do provide a basis for the kind of detailed experimentation needed to develop a reasonable mechanism. That the reaction as a chain has been shown rather definitely. The problem now is to find the chain carriers and the pathway of their reactions. From a practical point of view the general data indicate that in some circumstances sulfide and oxygen may coexist in aqueous solution for quite long periods of time. On the other hand the effects of metal ions in various types of organic compounds indicate that it will be difficult or impossible to predict a lifetime of sulfide in any given natural water even in the absence of biological effects. The catalytic effects of metal ions may however provide a means for speeding up the oxidation circumstances where it is desirable. (Hancuff-Texas)
W70-09949

VOLATILIZATION AND NITRIFICATION OF NITROGEN FROM URINE UNDER SIMULATED CATTLE FEED LOT CONDITIONS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
B. A. Stewart.
Environmental Science and Technology, Vol 5, No 7, p 579-582, July 1970. 1 fig, 7 tab, 7 ref.

Descriptors: *Nitrification, *Cattle, *Soils, Ammonia, Nitrogen Moisture content, Depth, Chemical oxygen demand, Farm wastes, Urine.
Identifiers: *Feed lots.

Virtually all the recent growth in cattle feeding has been in feeding units of 10,000 head or more in which cattle are confined in pens allowing 6 to 20 sq meters per animal. Animal wastes resulting from these large feeding operations cause concern in many areas. Disposal of the accumulation of solids wastes is difficult and in some cases run-off from these lots has caused pollution of streams and lakes. Feeding operations can cause high nitrogen concentrations in the underground water supply. There are large differences in the amount of nitrate found under feed lots: some contain large amounts, other nearly nitrate free, both at shallow and deep depth. The objectives were to simulate some feed lot conditions and study the nitrification and volatilization weights of nitrogen added as cattle urine to soil in an attempt to determine some of the factors governing nitrate accumulation under feed lots. Urine accounts for about half of the nitrogen excreted by cattle. When urine was added every two days to an initial wet soil at a rate of 5 ml per 21 cm sq, less than 25% of the nitrogen was lost as ammonia and about 65% converted to nitrate. When urine was added every 4 days to initially dry soil, essentially all the water evaporated between the urine additions, and 90% of the nitrogen was lost as ammonia. These findings suggest that the stocking rate and other management factors should be considered in pollution of the unit. (Hancuff-Texas)
W70-10023

COMPUTER DESIGN OF CMAS SYSTEMS,
Kansas Univ., Lawrence.
Daniel W. Smith.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA4, p 977-990, August 1970. 7 fig, 4 tab, 11 ref.

Descriptors: *Computers, *Computer programs, *Activated sludge, *Mathematical model, Waste water treatment, Sewage treatment, Design, Mixing, Cost, Optimization.
Identifiers: *Complete mixing conditions, Suspended solids, CMAS.

The complete mixing activated sludge (CMAS) model combined with cost information to allow selection of the most economical unit based on construction cost and operating conditions is developed into a computer designed program. The procedure followed is first to select a sludge age and aeration tank size and then solve the complete mixing activated sludge equations for each set of input data. The aeration tank size and sludge age values are incremented the desired number of times and amount with the calculations repeated each time. The cost of the secondary system is determined once for each aeration tank size and stored by the computer. The average unit BOD5 removal cost and average unit suspended solids removal cost are determined for each tank size. At each sludge age the aeration tank with the lowest unit BOD5 removal cost meeting the operational limits is selected. The processor time required for the actual execution of the program is 0.504 minutes based on a run using 15 sets of data 10 tank sizes, and 10 sludge age values. The cost of computer and related systems time and for the printing of the output is approximately $2.65. (Hancuff-Texas)
W70-10024

ANAEROBIC PROCESSES (LITERATURE REVIEW),
S. Ghosh, and F. G. Pohland.
Journal Water Pollution Control Federation, Vol 42, No 6, p 920, 934, June 1970. 99 ref.

Descriptors: *Anaerobic digestion, *Sludge treatment, *Digestion, Waste water treatment, Sewage treatment, Microbiology, Kinetics, Control, Organic loading, Efficiencies, Performance.
Identifiers: Applications.

A review of the 1969 literature on anaerobic processes is presented. Microbiology of anaerobic digestion is characterized by several authors in terms of the predominant species. A wide variety of substrates, intermediate products and end products are presented for the digestion process. There is an increased interest by researchers in developing rock filled upflow-type anaerobic filters. The loadings, efficiencies, and design parameters of this type filter are enumerated. Use of anaerobic denitrification is evaluated by several authors. The feasibility of treating dilute wastes under anaerobic conditions was investigated and a great deal of data is presented on loadings, efficiencies, sludge concentration, temperature influences and gas production. The advantages of multi stage anaerobic processes are elaborated. The effects of various parameters such as temperature, pH, electrode potential, and loading were reported. Many studies were made on the kinetics of digestion attempts were made at developing inhibition functions which reflected the growth limiting characteristics. Several methods were suggested for digester control, the oxidation reduction potential in combination with the pH being the most intensely discussed. Some applications of digestion were the digestion of carbohydrates, spent sulfide liquor, cane sugar, factory waste water, molasses decomposition distillary waste water and waste water from glycerol production. (Hancuff-Texas)
W70-10025

MIXED LIQUOR SOLIDS SEPARATION BY FLOTATION,
Federal Water Quality Administration, Washington, D.C.
Michael C. Mulbarger, and Donald D. Huffman.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 4, p 861-870, August 1970. 5 fig, 3 tab, 9 ref.

Descriptors: *Activated sludge, *Aeration, Waste water treatment, Performance, Design, Cost, Sludge, Suspended load, Sedimentation.
Identifiers: *Flotation, *Suspended solids, Loading, Thickening.

A full-scale dissolved air flotation unit designed for solids-liquid separation of an activated sludge mixed liquor was evaluated in a field investigation. The data indicated that conventional design parameters do not adequately predict flotation performance in terms of effluent suspended solids. A new parameter was developed and is proposed a rational design guideline. Conventional design criteria such as the solids loading rate and air solids ratio did not describe flotation performance in terms of the effluent suspended solids. A cost-quality comparison of flotation versus gravity sedimentation with waste sludge thickening indicated that overall planning and performance could have been improved for a substantial economic savings. A savings in tankage volume and area requirements would have resulted from the use of a conventional gravity clarifier with or without waste sludge thickening. If gravity sedimentation had been used, the total costs indicated that the expenditures associated with mixed-liquor solid separation would have been approximately 30% of the flotation costs. As compared to the use of a flotation unit alone, the combination of gravity sedimentation and waste sludge thickening by flotation would have produced a savings of about 48% ($0.03 per thousand gallons). (Hancuff-Texas)
W70-10026

SEWAGE TREATMENT SYSTEM ODORS AND AIR POLLUTANTS,
Stone (Ralph) and Co., Los Angeles, Calif.
Ralph Stone.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 4, p 905-909, August 1970. 3 tab.

Descriptors: *Odor, *Sewage treatment, *Air pollution, *Sewage, Waste water treatment, Aeration, Sludge, Chemicals, Incineration, Sewers, Costs, Activated sludge, Oxidation.
Identifiers: *Odor control, Threshold number, Sewer maintainance, Air pollution control.

The major pollution problem associated with sewerage systems is odor. Sludge or screening incinerators may discharge particulate matter, incompletely combusted or organic compounds and sulfur dioxides all of which are air pollutants. The intensity of sewage odor production is dependent upon the following factors: organic concentration, temperature, sulfate content, detention time, aggetation, microbes, pH, and flow depth. Methods of odor control are: (1) preventing the odors from forming, (2) preventing the odors from reaching the atmosphere, and (3) removing or renovating the odors which have been formed. Odors may be suppressed by: (1) sewer maintainence to remove biological slimes, grease, and silt; (2) addition of oxidation or reduction compound; (3) precipitation of sulfides; (4) waste pretreatment to reduce waste strength; and (5) the use of perfume masking agents. Odors can be prevented from reaching the atmosphere by sealing enclosures and collecting by partial vacuum within the disposal facility. The odors and air pollutants such as particulate matter and nitrogen oxides can be reduced by appropriate afterburners, scrubbers, activated carbon, or other specialized equipment. (Hancuff-Texas)
W70-10027

DETERGENTS (LITERATURE REVIEW),
S. K. Banerji.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 916-920, June 1970. 31 ref.

Descriptors: *Detergents, *Alkylbenzene sulfonates, *Linear alkylate sulfonates, Digestion, Waste water treatment, Sewage treatment, Phosphates, Biodegradation, Degradation (Decomposition), Surfactants.
Identifiers: Methylene-Blue Active Substance.

A review of the 1969 literature on detergents isi presented. A European council proposed a ban on detergents which were not 80% biodegradable. A report on the reduction of Methylene-Blue Active Substance in the Illinois river shows a drop from 0.54 mg/l in 1959 to about 0.05 mg/l in 1965. Several studies of the toxic effects of detergents on fish and the synergistic effects when combined with various insecticides is discussed. The mechanisms of detergent biodegradation and biodegradability is reported on by several authors. The role of algae in degrading surfactants is also discussed. A situation regarding anionic detergent toxicity to anaerobic digestion in the United Kingdom is reviewed. The processes for the removal of detergents from waters is included and efficiencies of various methods reported. The role of phosphates as a detergent builder and its eutrification implications are discussed. Boron salts an ingredient of detergents were found to be toxic to laboratory activated sludge units in concentrations greater than 10 mg/l. Environmental effects of the enzymes present in detergents seem to be of some concern. The enzymes were not present in the effluent of conventional waste water treatment plants and were nontoxic to rats at a dosage 10 grams per kg. (Hancuff-Texas)
W70-10028

CHEMICALS, BUGS TAME PROCESS WASTES.

Environmental Science and Technology, Vol 4, No 8, p 637-638, August 1970. 2 fig.

Descriptors: *Industrial wastes, *Waste water treatment, *Activated sludge, Biological treatment, Coagulation, Nutrients, Lagoon, Sludge, New Jersey.
Identifiers: *Polyvinyl chloride, Polyelectrolytes, Pedricktown (New Jersey).

A combination of coagulation and activated sludge treatment is being used by B. F. Goodrich Chemical Company for the treatment of a polyvinyl chloride waste. The waste is milky white and contains various amounts of monomers, polymers, dispersants, organic and inorganic salts, etc., in both suspended and dissolved forms. The one million dollar plant is based on design criteria of 90% reduction of ultimate BOD and flow of 800,000 gallons per day. The primary treatment consists of the addition of coagulant and coagulant aid in two compartment mixing tanks. Ferric chloride is used as a coagulant at a dosage of 150 ppm. Secondary treatment consists of an activated sludge process to which small amounts of nutrients, nitrogen and phosphorus must be added. Caustic soda is also added just prior to the aeration tank to keep the pH above 7. The effluent is then fed to a tertiary lagoon. The settled sludge from both chemical sludge and biological sludge thickners is centrifuged and dewatered to about 40 to 50% solids. The dewatered sludge is inert and trucked to land fill. Goodrich aims at eventually 100% reuse of its water supply but further treatment of the lagoon effluent will be necessary. (Hancuff-Texas)
W70-10030

LAGOONS AND OXIDATION PONDS (Literature Review),
W. C. Boyle.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 910-916, June 1970. 39 ref.

Descriptors: *Waste water treatment, *Lagoons, *Ponds, Oxidation, Biological treatment, Sewage treatment, Aeration, Temperature, Industrial wastes, Nutrients, Coliform, Efficiency, Poultry, Tertiary treatment.

A review of the 1969 literature on lagoons and oxidation ponds is presented. The review includes discussion of principles of aerated lagoon design. A pilot plant study to treat box-board white water and paper-board mill waste waters is outlined. Discus-

ion of several full scale aerated lagoons is resented and includes the design and cost of treatnent. A variety of industrial wastes are treated hrough pond and lagoons: Kraft mill wastes, pulp nd paper mill wastes, refinery and chemical astes, poultry wastes, hog slaughter house wastes, nimal wastes, dairy manure wastes and phenolic astes. Data are presented on the design, power equirements, organic loadings, efficiencies, effects f temperature, aeration requirements, nutrient equirements, coliform and pathogen removals, nd influence of detergents. The use of ponds as ertiary process is also discussed for a variety of astewaters. (Hancuff-Texas)
W70-10031

FWQA STEPS UP TERTIARY TREATMENT STUDY.
Environmental Science and Technology, Vol 4, No 7, p 550-551, July 1970. 4 fig.

Descriptors: *Tertiary treatment, *Nutrients, Nitrogen phosphorus, Nitrification, Denitrification, Waste water treatment, Biological treatment, Sewage treatment, Chemical precipitation, Pilot plants.
Identifiers: FWQA.

A general description is given of four processes currently being studied at the Advanced Waste Treatment facilities of the FWQA in Washington, D. C. All of the treatment sequences under investigation include processes that have as yet found little or no use in municipal waste water treatment. Three of the sequences include conventional primary treatment and secondary biological processes followed by tertiary nutrient removal steps. Another and independent physical-chemical system relies primarily on non-biological means of organic and nutrient removal. The main features of the treatment sequence which qualify them as advanced waste treatment are the capabilities for phosphate and nitrogen nutrient removal. Two alternative approaches are discussed in regard to the removal of nitrogen: physical-chemical and biological. Physical-chemical treatment is effected through pH adjustment. The pH is increased and the nitrogen stripped as ammonia. The second uses biological treatment to convert the nitrogen from the ammonia form to the nitrate form through nitrification and this is followed by biological denitrification, an anaerobic bacterial process. The independent physical-chemical treatment bypasses the conventional primary and secondary treatment steps; instead the incoming waste water is treated with lime in the two stage clarification process. The effluent from the phosphate removal step is treated in carbon adsorption columns and undergoes physical-chemical nitrogen removal. (Hancuff-Texas)
W70-10032

ARMCO STEEL FACILITY FEATURES POLLUTION CONTROL,
Armco Steel Corporation, Middletown, Ohio.
C. G. Kramer.
Civil Engineering, Vol 40, No 6, p 37-40, June 1970. 4 fig.

Descriptors: *Air pollution, *Waste disposal, *Water reuse, *Concrete construction, Waste water treatment, Industrial wastes, Deep wells, Water pollution control, Soils, Foundations, Groundwater, Ohio.
Identifiers: Middletown (Ohio).

Armco's new Middletown works has been named the outstanding engineering achievement of 1970. Perhaps the most significant aspect of the project is the attention and effort devoted to environmental quality. Altogether 14 separate air and water pollution control systems were planned and developed at a capital cost of nearly $39,000,000. Operation, maintenance and material cost for these systems will be about $4,000,000 per year. At the basic oxygen furnace, a Japanese 'off-gas' system was introduced to the U.S.; by treating dirty carbon monoxide gas before it is oxidized the volume of gases to be treated is reduced 75%, and the size of the gas cooling system is reduced 90%. The plant disposes of its acid wastes by deep well injection. Disposal of the pickle wastes in this way is considered to be both effective and safe. A 100,000 gallon per minute water treatment plant is employed to permit recycling of the water from hot rolling mills. The treatment consists of dosing the ferric sulfate and lime in the flash mix tanks. Additon of coagulant aids in the flocculation tanks is followed by clarification. To date the waste system meets all the objectives, for example, the intake stream has a 171 ppm suspended solids and the water discharge 8 ppm suspended solids. Also featured are imaginative designs in concrete specifications, piles, and strip-mill basements. (Hancuff-Texas)
W70-10033

5E. Ultimate Disposal of Wastes

WASTE DISPOSAL AND EARTHQUAKES AT THE ROCKY MOUNTAIN ARSENAL, DERBY, COLORADO,
Geological Survey, Washington, D.C.
H. K. Van Poolleen, and D. B. Hoover.
Journal of Petroleum Technology, p 983-993, August 1970. 11 p, 11 fig, 3 tab, 32 ref.

Descriptors: *Injection wells, *Earthquakes, *Colorado, Waste disposal, Faults (Geology), Crystalline rocks, Metamorphic rocks, Transmissivity, Porosity, Injection, Safety, Fractures (Geology).
Identifiers: Rocky Mountain Arsenal (Colo), Denver (Colo), Hubbert-Rubey theory, Waste disposal wells.

In early 1962 waste water was injected into a 12,000-ft well drilled in the pre-Cambrian near Denver, Colo. Since that time over 100 earthquakes large enough to be felt have occurred in this area where no quakes had been recorded before (one as high as Richter magnitude 5.3). In 1966 water injection was stopped, but earthquake activity has continued. Several mechanisms explain this phenomenon--the Hubbert-Rubey theory, reduction of coefficient of friction, hydraulic fracturing, and thermal and chemical effects. (Knapp-USGS)
W70-09539

UNDERGROUND WASTE DISPOSAL,
Gurnham and Associates, Inc., Chicago, Ill.
Charles A. Caswell.
Environmental Science and Technology, Vol 4, No 8, p 642-647, August 1970. 6 p, 5 fig.

Descriptors: *Injection wells, Hydrogeology, Waste disposal, Legal aspects, Safety, Environmental engineering.

The technology, hydrology, and legal status of deep disposal wells are briefly reviewed. Injection is ultimate disposal in the sense that wastes are held out of contact with the surface environment for a very long time, long enough to render many wastes harmless by geochemical processes before they reach the surface again. In many cases wastes are made safe enough that underground disposal is a valuable source of aquifer recharge. In many cases, however, injection is not feasible because wastes are too long-lived or the hydrogeology of the disposal horizon is not favorable for safety, long retention, or degradation of the wastes. Legal problems include underground trespass, liability for damage, and ownership of aquifers and groundwater. (Knapp-USGS)
W70-09543

SOME CONSIDERATIONS IN UNDERGROUND WASTE WATER DISPOSAL,
Ohio River Valley Water Sanitation Commission, Cincinnati; and Missouri Univ., Columbia. Dept. of Geological Engineering.
Edward J. Cleary, and Don L. Warner.
Journal American Water Works Association, Vol 62, No 8, p 489-498, August 1970. 10 p, 16 ref.

Descriptors: *Injection wells, *Waste water disposal, *Ohio River, *Industrial wastes, *Regulation, Water law, Monitoring, Hydrogeology, Legislation, Injection, Water wells, Water rights, Reviews, Publications.
Identifiers: Ohio River Basin, Orsanco, Waste disposal wells.

Two sections of a monograph on underground waste water disposal are presented and the entire monograph is briefly discussed. The monograph provides perspective on the status of underground injection practice and the social concerns and policy issues that relate to it, and offers regulatory guidelines and criteria for evaluating the location, design construction, and operation of injection wells, specifically with respect to geological and other circumstances in the Ohio Valley. Legal liabilities and constraints are more important than technical ones. All aspects of the planning, constuction, operation, and abandonment of waste-injection systems should be embraced in the regulatory process. Although only small areas of the Ohio Valley are limited for waste injection on the basis of hydrologic consideration of the rock units, geologic structure, and groundwater circumstances, only limited quantities of wastes should be regarded as eligible for subsurface disposal. Continuous records of waste water volumes and injection pressures should be kept. Monitoring of conditions at the injection interval or other intervals above or below the injection horizon is often desirable. (Knapp-USGS)
W70-09549

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES,
Alabama Univ., University, Natural Resources Center.
David M. Grubbs, Charles D. Haynes, and William E. Tucker.
Available from NTIS as PB-194 112, $3.00 in paper copy, $0.65 in microfiche. Alabama University Natural Resources Center, and Alabama Geological Survey Report, May 1970. 85 p, 23 fig, 2 tab, 42 ref. OWRR Project No B-019-ALA (2).

Descriptors: *Waste water disposal, *Injection wells, *Alabama, Aquifers, Aquicludes, Hydrogeology, Water law, Legal aspects, Groundwater movement, Permeability, Cost analysis, Water costs, Computer programs, Water conservation.
Identifiers: Waste injection wells.

Geological and engineering parameters which govern the disposal of liquid-waste material by deep-well injection were evaluated in Alabama. A study was made of geology to identify potentially favorable subsurface reservoirs. Physical properties controlling fluid movement and storage, and liquid wastes from industries were injected into core samples of actual reservoir rocks. Parameters required for confinement of wastes to assure the isolation of fresh water and other natural resources from adverse effects of waste injection were studied. A design and cost procedure was supplemented by a computer program to provide rapid feasibility studies. Data provided by wells drilled for oil and gas show several potential receptive horizons in the southwest portion of the state near Mobile. Until definition of legal responsibilities is clarified, disposal of liquid wastes in deep-wells should be undertaken only after study of capacity, permeability, confining beds, and control of the flow stream. Aspecial bibliography is included containing 460 entries. (Knapp-USGS)
W70-09771

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX A: DESIGN AND

COST OF LIQUID-WASTE DISPOSAL SYSTEMS,
Alabama Univ., University, Natural Resources Center.
Charles D. Haynes, and David M. Grubbs.
Available from NTIS as PB-194 113, $3.00 in paper copy, $0.65 in microfiche. Alabama University, Natural Resources Center, and Alabama Geological Survey Report, May 1970. 120 p, 36 fig, 2 tab, 21 ref, append. OWRR Project B-19-ALA (3).

Descriptors: *Waste water disposal, *Cost analysis, *Computer programs, *Alabama, Construction costs, Maintenance costs, Capital costs, Design, Aquifers, Hydrogeology, Water conservation.
Identifiers: Waste disposal wells.

Elements of the cost of waste water injection wells include capital outlay, maintenance, and operation. Design is critical to initial capital investment and is a contributing factor in other cost elements. The computer-derived cost of deep-well disposal systems is tempered to meet the physical parameters dictated by the geology of Alabama. An objective of the study is to conserve the fresh-water resource of the State if feasibility of this method of waste disposal can be established. Variable site cost factors include depth of the well, physical properties of the receptive horizon, mechanical limitations of the well design and equipment, and also management decisions with reference to investment in the disposal well and its components related to waste volume and alternate or stand-by disposal means. A computer program affords a flexible procedure for design and estimation of costs of deep-well disposal systems. Although the program is keyed to costs dictated by the geology of Alabama, it is applicable to any area by modification of tables pertaining to drilling costs. (Knapp-USGS)
W70-09772

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID INDUSTRIAL WASTES, FORMATION WATERS, AND MINERALS IN SALAQUIFERS OF ALABAMA; PART II, LABORATORY STUDY OF SELECTED RESERVOIR ROCKS,
Alabama Univ., University. Natural Resources Center.
David M. Grubbs, and Travis H. Hughes.
Available from NTIS as PB-194 114, $3.00 in paper copy, $0.65 in microfiche. Alabama University, Natural Resources Center, and Alabama Geological Survey Report, May 1970. 23 p, 3 fig, 5 tab, 11 ref. OWRR Project B-019-ALA (4).

Descriptors: *Water chemistry, *Waste water disposal, *Injection wells, *Alabama, Laboratory tests, Hydrogeology, Porosity, Permeability, Chemical reactions, Chemical precipitation.
Identifiers: Waste disposal wells.

Although the important chemical reactions in waste injection may be predicted, the physical effects of these reactions often are not predictable. Laboratory studies of a variety of reservoir rocks samples were conducted in an effort to establish storage capacity and flow parameters and to assess compatibility of potential receptive horizons with injected liquid wastes. Groundwater reservoirs with physical and chemical parameters favorable to injection of liquid wastes are at moderate depths in the geologic sections in a portion of Alabama. There should be no significant permanent reduction in porosity as a result of injection of sizable volumes of most of the State's industrial wastes. Permeability to continued flow of waste material showed a substantial decrease after a period of relatively few days, but could be restored to a level satisfactory for injection by flushing the aquifer with water. Permeability loss resulting in reduction of injection rates is greatest at the well face. Remedial action may be taken in some instances to restore flow to a suitable level. (Knapp-USGS)
W70-09773

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX C: STRATIGRAPHY OF ALABAMA (WITH A SECTION ON PHYSIOGRAPHY),
Alabama Univ., University. Natural Resources Center.
Donald B. Moore, and James Daniel Moore.
Available from NTIS as PB-194 115, $3.00 in paper copy, $0.65 in microfiche. Alabama University Natural Resources Center, and Alabama Geological Survey Report, May, 1970. 56 p, 4 fig. OWRR Project B-019-ALA (5).

Descriptors: *Stratigraphy, *Geomorphology, Alabama, *Geologic formations, Hydrogeology, Rocks, Geological surveys, Geologic time.

The following stratigraphic features of Alabama are briefly discussed: Paleozoic Rocks; Cambrian System; Ordovician System; Silurian System; Devonian System; Carboniferous System; Mississippian Series; Pennsylvanian Series; South Alabama Stratigraphy (Subsurface); Jurassic System; Cretaceous; Paleocene Series; Eocene Series; and Oligocene Series. Alabama lies partly in the following five physiographic provinces: Highland Rim Section of the Interior Low Plateaus, the Cumbeland Plateau Section of the Appalachian Plateaus, the Valley and Ridge, the Piedmont Upland Section of the Piedmont, and the East Gulf Coastal Plain Section of the Coastal Plain.
W70-09774

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 05D.
W70-09813

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 05D.
W70-09814

ON USING INDUSTRIAL AND DOMESTIC WASTES IN AQUACULTURE,
Maryland Univ., Solomons. Natural Resources Inst.
J. A. Mihursky.
Agricultural Engineering, Vol 50, No 11, p 667-689, 1969. 1 fig, 3 tab, 18 ref.

Descriptors: *Waste disposal, *Aquaculture, *Ultimate disposal, Domestic wastes, Industrial wastes, Sewage wastes, Byproducts, Fertilizers, Algae, Zooplankton, Fish, Shellfish, Steam, Electric power, Heated water, Proteins, Aquatic microorganisms, Temperature, Activated sludge, Fisheries, Carp, Clams, Ponds, Running waters, Fresh water, Brackish water, Economics, Cycling nutrients, Foods.
Identifiers: Petroleum wastes, Mercenaria mercenaria, Aquaculture, Recycling wastes.

Three waste materials have the greatest potential for recycling through aquatic systems into useful nutrients--petroleum wastes, sewage wastes, and waste heat. Protein developed and sold in France is produced by microorganisms growing on waste low-grade petroleum. Large-scale use of microbiologically derived proteins seems possible. Sewage converted to inorganic materials may provide fertilizer for algal production. Waste heat may assist in providing optimal environmental conditions for biological growth at all trophic levels. In various world situations sewage or sewage products are used to stimulate fishery production. Algae grown in mass aided by water from treated sewage and concentrated by evapodrying technique produces food for chickens. Waste heat from steam electric stations is used to raise carp in latitudes farther north than usual and to extend the growing season in some localities. A waste flue gas was used to supply carbon dioxide gas to mass-culture an algal food supply. Wild or natural water is preferable to pond culture. Running water systems permit dense stocking, waste removal and continued dissolved oxygen renewal. Costs of producing fish protein concentrate through aquaculture plus waste utilization will be subsidized by society's need to recycle its waste materials into useful foodstuffs. (Jones-Wisconsin)
W70-09905

SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
For primary bibliographic entry see Field 05D.
W70-09935

LAND SPREADING, A CONSERVING AND NON-POLLUTING METHOD OF DISPOSING OF OILY WASTES,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Ohio Basin Region.
G. K. Dotson, R. B. Dean, W. B. Cooke, and B. A. Kennar.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 15 p, 4 fig, 4 tab, 20 ref.

Descriptors: *Oils, *Oil waste, *Waste water disposal, *Soil microorganisms, Microorganisms, Bacteria, Fungi, Soils, Efficiencies, Laboratory tests, Test procedure.
Identifiers: *Land disposal.

Land spreading is shown to be economical and comparitively fool proof method of disposing of oily wastes. Although large additions of oil may create toxic conditions for plants the eventual effect upon soil is to provide physical and chemical properties by increasing organic matter and nitrogen content, decreasing volume weight and increasing porosity and moisture holding capacity. Soil microbes can oxidize and decompose large quantity of petroleum hydrocarbons under a wide range of soil and environmental conditions. Natural biochemical decomposition of oil in soil may be accellerated by judicious use of lime and fertilizer, artifical drainage and tillage. Microbiological degradegration of oily wastes take place under a wide range of temperature but oxidation is faster in warm or hot climates than in cold. A typical land disposal practice is described for an oil-water separator sludge consisting of an emulsion with about 20% hydrocarbon, 25% solid and 55% water. Various microbiological studies are reported in regard to the number and types of oil decomposing bacteria and fungi. (Hancuff-Texas)
W70-10029

5G. Water Quality Control

REPORT ON THE FEDERAL-STATE-INDUSTRY COOPERATIVE SAVANNAH RIVER WATER QUALITY STUDIES, 1956-1965.
Public Health Service, Atlanta, Ga. Savannah River Advisory Board.

U S Dept of Health, Education and Welfare, Public Health Service Report, November 1967. 173 p, 25 fig, 11 tab, 19 ref.

Descriptors: *Radioactive waste disposal, *Georgia, *Water quality, Radioactive wastes, Path of pollutants, Water chemistry, Monitoring, Sampling, Water quality control.
Identifiers: Savannah River.

From results of the U.S. Public Health Service studies, South Carolina and Georgia surveillance activities, Du Pont monitoring, and other related surveys and investigations, it is concluded that radioactivity releases to the Savannah River from the Savannah River Plant have been maintained well below the established guides and standards for radioactivity in the environment. The low activity levels attained reflect good waste management practices at the plant. The surveillance now being provided is adequate to take care of public health and other interests. The States are continuing their

cooperative program, comparing results with those obtained in Du Pont monitoring program. (Knapp-USGS)
W70-09552

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY.
Federal Water Quality Administration, Washington, D.C.

For sale by Superintendent of Documents, U S Government Printing Office, Washington, D.C. 20402 - Price $2.50. PB-193 939. Microfiche available from NTIS $0.65. Federal Water Quality Administration Water Pollution Control Research Series 11024, Compilation of Papers presented at Symposium on Storm and Combined Sewer Overflows, June 22-23, 1970, Chicago, Ill. 1970. 336 p. FWQA Project 11o24---6/70.

Descriptors: *Water pollution sources, *Water pollution control, *Storm runoff, *Cities, Sewage, Sewers, Waste Water treatment, Sewage treatment, Storm drains, Urbanization.
Identifiers: Combined sewers.

This compilation of papers contains results of the current demonstration grants and contracts that are being supported by the FWQA. The papers discuss: (1) alternatives to storm and combined sewer pollution in a small urban area; (2) screening and air floatation for solids removal; (3) underflow deep tunnel system concept; (4) urban erosion and sediment control; (5) sewer monitoring and remote control; (6) combined sewer overflow regulators; (7) use of fine mesh screens; and (8) land use and urban runoff pollution. (Knapp-USGS)
W70-09558

MATHEMATICAL MODELLING OF WATER QUALITY CHANGES IN A RIVER BASIN,
Hydraulic Research Inst., Brno (Czechoslovakia).
Vladimir Novotny.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 1, 1970, p I-5/1 - I-5/7. 4 fig, 5 ref. Preprint.

Descriptors: *Impaired water quality, *Mathematical models, *Natural streams, *Self-purification, Water temperature, Biochemical oxygen demand, Dissolved oxygen, On-site data collections, Digital computers.
Identifiers: *Non-conservative pollutants, Steady state, Dynamic state.

Problems and design are discussed of a suitable mathematical model which would apply for small and medium streams. Water quality as related to non-conservative pollutants in steady state and dynamic state were discussed and modeled. A river network was divided into sections connected by junction and it was assumed that self-purification processes took place in the sections while waste effluent and tributaries were situated at junctions. The input parameters included water temperature, length of section, approximate function of dependence of detention time in section on discharge, the dependence of average depth on discharge, parameters of limiting concentrations of BOD, COD, etc. The dynamic water quality model is more time consuming and needs of greater computer storage capacity than the steady state model. Observed data are in good agreement with the models. (Hsieh-Vanderbilt)
W70-09593

THE CONTROL OF RIVER HEATING BY ACCURATE DIGITAL SIMULATION,
Motor-Columbus Engineering Co., Baden (Switzerland).
P. Bogh, and H. Zund.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 10-14, 1970, Vol. SM-146, No 45, Preprint. 14 p, 4 fig, 4 ref.

Descriptors: *Thermodynamic behavior, *Nuclear powerplants, *Computer programs, Mixing, Cooling water, Cost-benefit ratio, Cooling towers, Model studies, Velocity, Water temperature, Meteorological data, Air temperature, Heat transfer, Hydraulic systems, Digital computers, Solar radiation, Evaporation, Condensation, Convection.
Identifiers: *Switzerland, River geometry.

The thermodynamic behavior of rivers and river systems was carefully investigated in Switzerland, a country without access to the sea and dependent on river cooling for economic nuclear power generation. To approach the problem, it was decided to prepare a digital simulation to reproduce the thermodynamic behavior of the rivers. The program specially developed for this application allowed for the variation of all basic parameters in such a way that the comparison between measured and computed river temperatures would permit the improvement of the heat transfer coefficients. The program allowed for tributaries with variable temperatures, several different time-varying meteorological conditions along the river, heat sources with time-variable intensity, variable river geometry, and simulation of the dispersion by having two channels with different water velocities. A time interval of just one half an hour in the simulation permitted a close watch on the important daily temperature variations. The results showed the importance of daily temperature variations in adjusting the heat transfer coefficients. (Osborne-Vanderbilt)
W70-09594

THERMAL STANDARDS IN THE UNITED STATES OF AMERICA,
Federal Water Pollution Control Administration, Duluth, Minn. National Water Quality Lab.
D. I. Mount.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 10-14, 1970. Vol SM-146, No 15, Preprint, 5 p.

Descriptors: *Temperature control, *Standards, *Water temperature, Seasonal, Monthly, Aquatic life, Interstate rivers, Hypolimnion, Volume, Mixing, Safety, Water cooling, Anaerobic conditions, Algal control, Spawning, Warm-water fish.

Temperature standards specifying permissible water temperatures for interstate rivers and lakes of the United States have been established. Standards for aquatic life must insure a seasonal temperature cycle, and so twelve maximum monthly temperatures are the minimum to describe desired conditions. In streams, a 5F rise may be permitted as long as the resulting temperature does not exceed the appropriate monthly maximum. In lakes, a 3F rise may be used with an additional requirement that the hypolimnion cannot be warmed or changed in volume. Mixing zones pose a difficult regulatory problem. They are difficult to restrict as to size and shape especially because the effects of mixing zones on receiving water depends, in part, on the number of mixing zones and the size of the lake or river. Where cooling devices are required, the standards do not specify the type to be used. The frequency that devices will not meet the standards has not been well defined except in a general way. If no safety margin is permitted, standards must be more complex in order to insure acceptable conditions. (Osborne-Vanderbilt)
W70-09595

DETROIT SEWER MONITORING AND REMOTE CONTROL.
Detroit Metropolitan Water Services, Mich.

In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 219-290, June 22-23, 1970. 33 fig, 4 tab. FWQA Project 11020 FAX.

Descriptors: *Overflow, *Remote control, *Regulated flow, *Sewers, Storm drain, Water pollution control, Flood control, Instrumentation, Computers, Cost, Urbanization.
Identifiers: *Combined sewers, *System monitoring, Storm flow anticipation, First flush interceptor, Selective retention, Selective overflowing.

Detroit is faced with the problem of preventing pollution of the Detroit and Rouge Rivers from its combined sewer system overflows. As an alternative to undertaking a dubiously effective sewer separation program, estimated to cost in excess of two billion dollars, the Detroit Metro Water Department has installed the nucleus of a sewer monitoring and remote control 'System' for controlling the pollution from the combined overflow from many small storms at a cost of slightly over two million dollars. The 'system' includes telemetering rain gages, sewer level sensors, overflow detectors, a centrally located computer and data-logger, and a centrally located operating console for controlling pumping stations and selected regulating gates. Installation has been virtually completed and now enables applying such pollution control techniques as 'storm flow anticipation,' 'first flush interception,' 'selective retention,' and 'selective overflowing.' An evaluation of the effectiveness of this initial installation will serve as the basis for determining what additional pollution control facilities are required, what suburban monitoring and remote control is essential, what computer related equipment for pump and valve control can be used for more effective pollution control, what automatic sampling and analysis will be more valuable in the synchronous operation of the sewerage system and what design parameters should be used in the construction of new or supplemental sewers or treatment facilities. (See also W70-09558). (Marriott-Chicago)
W70-09620

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWERS BUCYRUS, OHIO,
Burgess and Niple Ltd., Columbus, Ohio.
For primary bibliographic entry see Field 05B.
W70-09621

SAN FRANCISCO BAY IS NOW PRE-SHRUNK,
Thomas H. Harris.
In: All clear, Winter 1969, p 17-20, 3 photo, 1 map.

Descriptors: *Water pollution control, *Water quality control, *Entropy, Inter-agency cooperation, Sewage treatment, Standards, Financing, Attitudes.
Identifiers: *San Francisco Bay, Bay Conservation and Development Commission, Environmental quality.

The once shrinking San Francisco Bay is staging a comeback. Since the initiation of a pollution control program in 1956, $400 million have been spent jointly by the Federal and State governments. Progress has been slow but it can be seen in oil free waters, more abundant fish and shellfish, and in a reduction in the flow of organic material. The San Francisco Regional Water Quality Control Board, chiefly responsible for the program has set new standards for turbidity and discoloration of receiving waters, and limits have been set on thermal pollution from power plants and industrial sources. Planned actions include requirements that all ships and watercraft be equipped with self-contained sewage holding systems and with provisions to connect to dockside receiving tanks. A 30 year, $2 billion, joint collection and tertiary treatment system for the entire Bay Area is also envisioned. The problems are not all solved, however. San Francisco still has an antiquated combined storm drain-sewer, and in many areas sewage is only given primary treatment. Water quality standards are not being met at most discharges and existing standards are also outdated. All of these programs need tremendous public spending in order to be successful. Vocal citizens and conservationists have caused the establishment of a permanent body, the Bay Con-

servation and Development Commission, to legislatively protect the Bay. It remains to be seen whether the public is willing to put their money where their mouths have been. (Marriott-Chicago)
W70-09634

WATER POLLUTION: GREATER CALUMET AREA-INDIANA-ILLINOIS.
League of Women Voters of Chicago, Ill.

League of Women Voters of Chicago, Chicago, April, 1966. 16 p, 35 ref, 2 fig (Mimeographed).

Descriptors: *Pollution abatement, *Illinois, *Indiana, *Pollutant identification, *Water users, *Industrial wastes, Sewage, Waste treatment, Federal Water Pollution Control Act.
Identifiers: *Greater Calumet Area, *Metropolitan Sanitary District of Greater Chicago, *Public Health Service, *Federal Water Enforcement Conference, Thomas J. O'Brien Locks, Calumet River, Water quality criteria, Lake Michigan Basin, Illinois River Basin.

The water pollution problems of the Great Calumet Area are reviewed utilizing resource material, a summary of a U.S. Public Health Service Report (Dec. 1964) and a resume of the 1965-66 Federal Water Enforcement Conference held in Chicago. The Greater Calumet Area is defined, and definitions of pollution are given for the area within the Metropolitan Sanitary District of Greater Chicago and for the remainder of Illinois. While there is no specific federal statute that defines pollution, Congress has legislative authority, and the Federal Water Pollution Control Act gives the federal government responsibility for control and prevention. Findings and conclusions of the U.S. Public Health Report are reviewed. With regard to water users, facts are included concerning municipal water supply, industrial water supply, waste disposal and assimilation, waterborne commerce, recreation, and aesthetics. Industrial and sewage wastes are concluded to be principal pollutants although others are mentioned as significant at times. Findings regarding the percentage of each in the Illinois River Basin and the Lake Michigan Basin are listed. The purpose, legal basis, and conferees at the Federal Enforcement Conference held in March 1965 at Chicago are mentioned. Review is included of testimony from federal, state and MSD representatives. Interstate abatement efforts are agreed to be inadequate and eight standards for immediate remedial action recommended. Included are evaluation of water quality criteria, necessity of at least secondary treatment, minimization of industrial discharges, development of time schedules for constructing waste treatment facilities, sampling of industrial effluent, closing of Thomas J. O'Brien locks on the Calumet River and surveillance of the recommendations by conferees. (Preckwinkle-Chicago)
W70-09647

OPTIMAL TAXING FOR THE ABATEMENT OF WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
Jerome E. Hass.
Water Resources Research Vol 6, No 2, p 353-365, April 1970.

Descriptors: *Water pollution, *Taxes, *Water quality, *Economic evaluation, Planning, Optimization, Cost, Treatment costs, River basin, Waste disposal, Dissolved oxygen, Management, Income, Mathematical studies, Model studies, Organic waste, Streamflow, Flow rate, Rivers, Total cost.
Identifiers: *Dantzig-Wolfe algorithm, *Miami River, *Externalities, Income redistribution.

This paper is concerned with the use of taxes to internalize the costs of pollution. The analysis considers the role of a central authority and provides justification for the imposition of pollution taxes to elicit optimal treatment behavior from each polluter within a basin. The author then derives a rudimentary river basin model that incorporates the fundamental hydrological characteristics of the basin, the imposition of dissolved oxygen standards, and the effects of treatment of organic waste and low flow augmentation on the dissolved oxygen content of a river. This is a mathematical programming model which must be solved by the central authority. The analysis further demonstrates how the Dantzig-Wolfe non-linear decomposition algorithm can be used to achieve the standards imposed at minimum cost to society and to determine the tax structure required to achieve this solution. (Murphy-Rutgers)
W70-09652

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
Neal P. Dixon, David W. Hendricks, A. Leon Huber, and Jay M. Bagley.
Available from NTIS as PB-194 065, $3.00 in paper copy, $0.65 in microfiche. Utah Water Research Laboratory Report PRWG67-1, June 1970. 87 p, 58 fig, 20 tab, 77 ref, 8 append. FWPCA Project 16090 DWR---6/70.

Descriptors: *Systems analysis, *Simulation analysis, *Model studies, *Water quality, *Reservoirs, River basins, Dissolved oxygen, Biochemical oxygen demand, Conductivity, Water temperature.
Identifiers: *Computer requirements, *Program options, *Utah State University.

The development of a river basin simulation model comprising dissolved oxygen, temperature, specific electrical conductance, and basin hydrology submodels is demonstrated. The system model is the device for studying practical questions involving some measure of efficiency - whether this be pollution minimization by treatment and flow regulation, maximizing water use with the quality constraint, maximizing economy efficiency, or in developing more comprehensive water laws. These questions can be ascertained by simulation of altered conditions, sensitivity analysis, or some optimization technique. Although the model in this report was developed for a specific prototype system, the Little Bear River in Utah, the approach, the methods and the conceptual framework can be transferable to other systems. (Woodard-USGS)
W70-09740

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.

Available from NTIS as PB-194 032, $3.00 in paper copy, $0.65 in microfiche. Federal Water Pollution Control Administration Research Series, August 1969. 82 p, 10 fig, 12 tab, 4 ref. append.

Descriptors: *Storm drains, *Sewers, *Overflow, *Solid wastes, *Filters, Research and development, Model studies, Storm runoff.
Identifiers: *Rapid-flow filter, *Combined sewer overflows, Suspended solids, Settleable solids.

In a pilot installation up to about 65% of solids from overflows of combined sewer systems were removed by using lump coal as a rapid-flow filter. The lump coal was sized to three-fourths by one and one-fourth inches, free of fines, and about eight inches in depth. The overflow is directed onto the filter bed in such a manner that the filter bed is not displaced. When plugged, or upon a routine basis, the filter bed is replaced; the spent bed, composed of coal and solids, is incinerated or landfilled or disposed of by whatever manner is locally in use which does not pollute the atmosphere or surface or underground waters. The potentially most valuable contribution in the work was the finding that conventional sewage sampling does not provide a representative indication of the nature of large solids content. A recommendation for an improved sampling procedure is made. (Woodard-USGS)
W70-09741

AERATED GRIT CHAMBER WITH TANGENTIAL INLET,
Technical Univ. of Prague (Czechoslovakia).
For primary bibliographic entry see Field 05D.
W70-09761

THE PERSISTENCE OF PESTICIDES IN IMPOUNDED WATERS,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 05B.
W70-09768

ENVIRONMENTAL QUALITY AND THE ILLINOIS LAWYER,
John L. DeLaurenti.
Illinois Bar Journal, Vol. 50, p 605-615 (1970). 7 p.

Descriptors: *Illinois, *Environment, *Environmental effects, *Conservation, Resource development, Administrative agencies, Legal aspects, Pollution abatement, Water pollution, Air pollution, Soil contamination, Thermal pollution, Governments, Federal government, State governments, Local governments, Air pollution effects, Regulation, Water pollution effects, Coordination.
Identifiers: *Associations.

The Board of Governors of the Illinois State Bar Association has authorized the creation of an Environmental Control Law Section. A few of the environmental problems recognized by the Section council are: (1) air pollution; (2) water pollution; (3) lethal contamination from pesticides; (4) nuclear radiation; (5) noise; (6) land use; (7) continuing need for historic conservation activities; (8) scrap, junk and solid wates; and (9) population density. A brief discussion of each problem is presented. Most of these problems are under study by various federal agencies, often working without coordination. The lack of agency coordination also exists at the state and local level. The problem of direction and control within Illinois agencies is examined. One of the recent international developments has been the passage of Canadian legislation proscribing the use of the pesticide DDT except in emergency cases. The role of the legal system and lawyers in solving environmental problems will be one of developing a new set of standards which are workable and practical, yet effective. (Powell-Florida)
W70-09784

AGRICULTURAL IRRIGATION AND SALINE QUALITY OF WATER.
For primary bibliographic entry see Field 03B.
W70-09787

OFFSHORE MINERAL RESOURCES: A CHALLENGE AND AN OPPORTUNITY.
For primary bibliographic entry see Field 06E.
W70-09788

ACT NO 769 (DISPOSAL FROM WATERCRAFT OF LITTER AND UNTREATED SEWAGE PROHIBITED).
For primary bibliographic entry see Field 06E.
W70-09790

REPORT TO THE CITY OF FLINT, MICHIGAN ON SANITARY AND STORM SEWER SYSTEMS.
Metcalf and Eddy, Inc., Boston, Mass.

Report to Department of Public Works and Utilities, City of Flint, Michigan, September 12, 1969. 159 p, 11 fig, 12 tab, 11 ref.

Descriptors: *Sanitary engineering, *Sewers, *Sewerage, *Flow separation, *Infiltration, *Drainage systems, *Drainage practices, *Drainage engineering, *Urbanization, *Municipal wastes, *Pollution abatement, *Storm runoff, *Water pollution control, Sewage treatment,

treatment facilities, Flood protection, Flood plan ning, Construction costs, Future planning.
dentifiers: *Combined-sewer separation, *Sanita- sewers, Basement flooding.

he report describes the study procedures and resents the findings, conclusions, and recommen- ations of an engineering investigation of the dequacy of the sanitary sewer and storm sewer ystems and the waste water disposal facilities of he City of Flint. The sewer systems performed heir present functions satisfactorily; however, ajor problems were: (1) basement flooding, (2) iver pollution, and (3) potential flooding from fu- re stormwater discharges from adjoining ownships. In addition to recommendations for ystem improvements and expansion of existing acilities, several far-reaching and unconventional ecommendations were made. One of these is to eparate the downtown combined-sewer system by onstructing a new storm sewer system in this area nd converting the existing combined-sewer to a eparate sanitary sewer. This construction, esti- nated to cost $2 million, should be effective in educing river pollution and basement flooding rom overflows of the present combined-sewer. Another recommendation is to remove all connec- ions to sanitary sewers from roof drains, founda- ion drains, and parking lots. The City should enact egislation to prohibit future connections to the sanitary sewer system from foundation drains or other sources of surface water or groundwater. Special field investigations of surface and ground- water infiltration into existing sewers are also recommended. A $30,644,000 construction and improvement program is proposed. The need for cooperation between Flint and Genesee County is stressed, particularly for rainfall and runoff data collection and flood plain conservation. (Poertner) W70-09797

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Report to Metropolitan Sanitary District of Greater Chicago, Chicago, Illinois, February 1969. 49 p, 13 fig, 3 ref.

Descriptors: *Tunnels, *Underflow, *Beneficial use, *Underground storage, *Drainage programs, *Drainage effects, *Drainage engineering, *Storm runoff, *Surface runoff, *Urbanization, *Water conservation, *Flood control, *Water supply, *Water table, *Water resources development, *Water pollution control, *Lake Michigan, *Sewers, *Resource allocation, *Groundwater recharge, Drainage systems, Navigation, Deep wells, Water allocation.
Identifiers: *Chicago, *Metropolitan Sanitary District of Greater Chicago, *Combined sewer overflows.

The anticipated consequences are described of implementation of the proposed innovative plan for eliminating flooding and reducing pollution of waterways from combined sewer overflows in the service area of the Metropolitan Sanitary District of Greater Chicago. The plan proposes the construction of the vertical shafts, and excavation of tunnels and storage areas in solid rock deep beneath the ground surface for temporary storage of stormwater runoff which presently floods basements and streets when sewer capacities are exceeded. Upon cessation of a storm the stored water would be pumped to the ground surface and then to one of the District's waste water treatment plants for tertiary treatment. The capture of this runoff would make available for beneficial uses an estimated 260 cfs of water. In addition, implementation of the plan should make possible a 230 cfs reduction in the 945 cfs presently diverted from Lake Michigan for maintenance of sanitary conditions in the area's waterways. These savings would increase the available water supply by 490 cfs. This is one-half of the forecasted additional water supply that will be required by the year 2000. Other beneficial effects are discussed including: improvements in navigation on the Illinois Waterway, elimination of stream pollution from combined-sewer overflows, and recharge of the area groundwater supply. The basic principles of the plan are discussed, and an evaluation of the plan by the Illinois State Water Survey is included. (Poertner) W70-09798

POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Report to Metropolitan Sanitary District of Greater Chicago, Chicago, Illinois, February 1968. 39 p, 7 fig, 2 tab, 5 ref.

Descriptors: *Drainage programs, *Drainage engineering, *Water pollution control, *Flood control, *Tunnels, *Underflow, *Storm runoff, *Surface runoff, *Urbanization, *Lake Michigan, *Drainage systems, *Underground storage, *River regulation, *Sewers, Construction costs, Waste water, Water conveyance, Water quality control, Water pollution treatment, Hydroelectric power.
Identifiers: *Combined sewer overflows, *Chicago, *Metropolitan Sanitary District of Greater Chicago.

A general description is presented of an innovative program for control of water pollution and flooding in the service area of the Metropolitan Sanitary District of Greater Chicago. The report describes the objectives, functions, operation and characteristics of the proposed system, construction time schedules, and estimated construction costs. The plans provide for the construction of vertical shafts to convey overflows, from each of the 400 overflow points of the existing combined sewers, to high velocity conveyance tunnels excavated in rock several hundred feet beneath the ground surface. The overflows would be stored temporarily in a huge reservoir to be excavated in rock 850 feet below Lake Calumet. Upon cessation of overflow and during off-peak hours, the stored water would be pumped to a surface reservoir and then to a treatment plant for treatment prior to discharge to the waterway. The $1,270,000,000 project is proposed to be constructed in 5 construction zones within a 300 square mile area during a 10-year period. The first zone would be completed by early 1973 if construction is begun in early 1970. Hydroelectric power generation is proposed as a part of the system operatin. Cost comparisons with three alternative solutions are given. The engineers estimate that the proposed system can be completed to meet water quality standards of the State of Illinois by the 1977 time limit. (Poertner) W70-09799

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09801

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09802

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
For primary bibliographic entry see Field 05D.
W70-09804

FEDERAL PROGRAMS STUDY WASTES FROM RAW AGRICULTURAL PRODUCTS,
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 05D.
W70-09805

DYNAMIC PROGRAMMING AND ESTUARINE WATER QUALITY CONTROL,
Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
Robert T. Keegan, and J. Venn Leeds, Jr.
Water Resources Bulletin, Vol 6, No 2, p 235-248, March-April 1970. 14 p, 5 fig, 2 tab, 12 ref.

Descriptors: *Dynamic programming, *Optimization, *Estuaries, *Water quality control, *Mathematical models, Constraints, Stochastic processes, Dissolved oxygen.
Identifiers: Algorithm, Langrangian problem, Allocation problems, Galveston Bay System.

An optimization algorithm that allowed one to consider multidimensional water quality models, area growth and various control or decision alternatives for the Galveston Bay System was developed. The problems were formulated as allocation problems and were solved using dynamic programming. The solution to the allocation of resources problem of minimizing (or maximizing) a given scalar valued function of the positive N-vector w subject to constraints upon the use of the resources was obtained by solving the Langrangian problem for a given set of Langrangian multipliers Control or decision variables were included at each activity. The general deterministic water quality problem was formulated to minimize cost of waste treatment and of distribution subject to constraints on quality and to constraints on the maximum amount of waste to be discharged. To illustrate the algorithm the simplest permissible model was used. Stochastic effects and the use of a two-dimensional model were included. Data from the Tracor report on Galveston Bay were selected in order to simulate, to some extent, the water quality of the Houston Ship Channel. The dissolved oxygen deficit resulting from the complete discharge of the wastes was shown . (Kriss-Cornell) W70-09819

RIGGS V CITY OF SPRINGFIELD (ACTION TO ABATE TEMPORARY NUISANCE NOT BARRED BY STATUTE OF LIMITATIONS).
For primary bibliographic entry see Field 06E.
W70-09825

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
For primary bibliographic entry see Field 06A.
W70-09908

MARINE WASTE DISPOSAL IN GHANA-WATER QUALITY EVALUATION,
University of Science and Technology, Kumasi (Ghana).
For primary bibliographic entry see Field 05D.
W70-09939

AERATION OF OXYGEN-DEFICIENT IMPOUNDMENT RELEASES,
New Mexico State Univ., Las Cruces.
R. E. Speece.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 11 p, 8 fig, 5 ref.

Descriptors: *Aeration, *Oxygen demand, *Impoundments, *Dissolved oxygen, Water quality, Hypolimnion, Nitrogen, Bubbles, Injection.
Identifiers: *Water releases, U-tube aeration.

Commercial oxygen is presently competitive with conventional aeration systems in river and impoundment aeration. In addition complete dissolved oxygen saturation can easily be achieved using commercial oxygen whereas conventional aeration becomes increasingly uneconomical above about 40% saturation. In-place hypolimnion

aeration accomplished by injecting small bubbles of commercial oxygen deep in the hypolimnion can provide for complete absorption of the oxygen. Localized mixing for distribution of the dissolved oxygen within the hypolimnion is created by the rising bubbles before they are completely absorbed. Provision to inject into the penstocks of a high dam in combination with inplace hypolimnion aeration can provide a polishing system for positive DO control in the discharge. U-tube aeration with air injection appears to be most advantageous for DO addition where a warm water fishery is involved. It can produce a completely saturated water easily and economically even though it initially contains low DO levels. Intermediate levels of saturation are easily produced by regulating the U-tube depth and rate of air injection. U-tube aeration with air injection does not lend itself to applications where dissolved nitrogen must be below 104%. Aeration of oxygen defficient impoundment releases for improvement of water quality appears to be feasible on a large scale without destratifying the impoundment. Thus the reserve of colder water in the hypolimnion is kept intact for control of downstream temperatures. (Hancuff-Texas)
W70-09944

STEWART V CITY OF SPRINGFIELD (CONSTRUCTIVE CONDEMNATION OF A STREAM BY POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09979

MADDOX V INTERNATIONAL PAPER CO (PAPER MILL'S LIABILITY FOR FISHKILL CAUSED BY WATER POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09980

HAMPTON V NORTH CAROLINA PULP CO (ACTION TO RECOVER FOR FISHKILL CAUSED BY PULP WASTES).
For primary bibliographic entry see Field 06E.
W70-09981

UNITED STATES V FLORIDA POWER AND LIGHT CO (INJUNCTION AGAINST THERMAL POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09982

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME I - INTRODUCTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-193 862, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Report 118, May 1970. 83 p, 16 tab, 29 fig, 7 ref, append. OWRR Project C-1377 (No 1975) (1).

Descriptors: *Simulation analysis, *Optimization, *Computer programs, *Planning, *Management, Systems analysis, Reservoirs, Water resources, Texas.
Identifiers: Transfer links.

The research project developed applied new and existing techniques to the planning of complex water and related land resource systems of the Trans-Texas Division of the Texas Water Plan, a system of major proportions that involved many reservoirs, canals, and pumping facilities spanning the state of Texas. The planning problem posed was how best to develop such a system, given the necessity to meet the predetermined demand schedule over the 50-year planning horizon. Such questions as: when should elements of the system be constructed and available for service; how large should they be; how much water should be imported; and others were posed. To provide the planner with some objective and reliable means for answering such questions and for investigating systematically the alternatives presented, the systems approach technique used utilized four specialized computer programs: Stage Development, Simulation Program I, Simulation Program II and the Allocation Program. The screening procedure which used these four programs was divided into four distinct phrases: Element Sizing and Reservoir Operating Rules, Initial Screening using the Stage Development Program, Secondary Screening to refine the schedule and improve element sizes, and Final Screening using the Allocation Program where actual inputs and demands over the planning horizon were used and constraints imposed. The significant conclusion given was that the approach, developed and tested, for the screening of alternative water resource development plans, was efficient and feasible. (See also W70-09512 thru W70-09519) (Kriss-Cornell)
W70-09511

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 086, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-A - SIM-I Program Description, August 1969. 143 p, 13 fig, 12 tab, 4 append. OWRR Project C-1377 (No 1975) (2).

Descriptors: *Simulation analysis, *Computer programs, *Reservoirs, *Conduits, *Optimization, Design data, Management, Texas, Water storage, Water transfer.
Identifiers: Stage-development program.

A full description of SIM-I; the annual stage-development and seasonal operation of the predefined multi-basin water resource storage and transfer scheme of the Texas Water Plan, was given. The program computed seasonal spills and deficiencies, storage levels, river flows, and pump-canal transfer rates, and then computed costs for pump power, imported water, and staged construction of storage and transfer facilities. System geometry, cost data, and hydrologic data were input parameters. SIM-I was an efficient method for evaluating the operational feasibility and costs of alternative system configurations and constraints for the generalized multi-basin system of reservoirs and conduits. The program was designed to operate as a stand-alone analysis tool or to operate as a subprogram in the stage-development program. Simulation of the system operation was described by a series of steady state solutions, one for each time step, that satisfy continuity for all storage elements. Data requirements, program capabilities, and program descriptors were given for the system. (See also W70-09511) (Kriss-Cornell)
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.

Available from NTIS as PB-194 087, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-B - SIM-II Program Description, Aug 1969. 120 p, 5 fig, 14 tab. OWRR Project C-1377 (No 1975) (3).

Descriptors: *Simulation analysis, *Optimizati
*Computer programs, *Cost, *Time, Wa
transfer, Management, Texas.
Identifiers: Nodes, Links.

SIM-II was a computerized procedure designed
simulate and optimize certain behavioral char
teristics and aspects of the large scale surface wa
distribution system of the Texas Water Plan. T
computer program simulated the storage respon
of the system while at the same time minimized t
total cost of material transfer within the co
plicated network. A solution was produced
each finite time interval with analysis moving fo
ward in a step-wise fashion. SIM-II was more fle
ble and realistic than SIM-I but with higher cost
operation. It used less computer time than the All
cation Program but solutions were only a series
suboptimal time step solutions, not solutions ov
an entire time span. Six solution steps were fo
lowed and two primary analytical tasks were pe
formed: simulation of storage levels and determin
tion of intersystem transfers to meet storage leve
at minimum cost. SIM-II could simulate and o
timize a network with up to 30 nodes and 45 link
Mathematical descriptors, data requirements, pr
gram capabilities and program descriptions we
given. (See also W70-09511) (Kriss-Cornell)
W70-09513

**A COMPLETION REPORT ON SYSTEM
SIMULATION FOR MANAGEMENT OF
TOTAL WATER RESOURCE: VOLUME II-C
ALLOCATION PROGRAM DESCRIPTION.**
Texas Water Development Board, Austin.

Available from NTIS as PB-194 088, $3.00 i
paper copy, $0.65 in microfiche. Completion Re
port of the Texas Water Development Board an
Water Resources Eng, Inc, Vol II-C - Allocatio
Program Description, Aug 1960. 168 p, 12 tab,
fig. OWRR Project C-1377 (No 1975) (4).

Descriptors: *Optimization, *Computer programs
*Reservoirs, *Canals, *Networks, Flow, Cost
Time management, Texas.
Identifiers: *Allocation program, Out of kilter al
gorithm.

An Allocation Program was used to find the
minimum cost way of transferring water through a
network of reservoirs and canals, the sizes of reser
voirs and canals, and reservoir operating rules for
use in Simulation programs. The problem was
structured as a network flow problem and then
solved by the 'Out of Kilter Algorithm'. The results
included, for the time period simulated, all canal
and river flows, reservoir storage levels, import
quantities, and power needs. The marginal costs of
the canal and reservoir sizes were also determined.
A trial and error process sized the facilities and was
used to check the timing of their construction. A
complete description of the program was given.
(See also W70-09511) (Kriss-Cornell)
W70-09514

**A COMPLETION REPORT ON SYSTEMS
SIMULATION FOR MANAGEMENT OF A
TOTAL WATER RESOURCE: VOLUME II-D -
STAGE DEVELOPMENT PROGRAM DESCRIP-
TION.**
Texas Water Development Board, Austin.

Available from NTIS as PB-194 089, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-D - Stage Development Program Description, Aug 1969. 89 p, 9 fig, 10 tab. OWRR Project C-1377 (No 1975) (5).

Descriptors: *Optimization, *Simulation analysis, *Project planning, *Time, *Cost, Variability, Reservoirs, Canals, Management, Texas.
Identifiers: *Stage development.

The Stage Development PROGRAM, AS PART OF THE OVERALL Texas Water Plan, was used to estimate the sequence of project construction over a 50 year planning horizon in order to produce the least costly system of reservoirs and canals, and satisfy the demand for water. The planning horizon was divided into 3 periods consistent with the political and physical constraints. Three different calculations involved: (1) net hydrologic balance giving storage needs as a function of time; (2) random sampling of possible construction start times of system elements with the costs of each element estimated using simulation; and (3) a deterministic sequential search using simulation to improve a given set of possible start times. The entire simulation was thought of a s a system response function: th independent variables of the function were reservoir and canal construction times and the dependent variables were the present value of construction and operation costs of the water resource project and cumulated project shortages over the planning horizon. Simulation and Allocation programs were used. (See also W70-09511) (Kriss-Cornell)
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME III - DATA MANAGEMENT.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 090, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol III - Data Management, Aug 1969. 229 p, 10 fig. OWRR Project C-1377 (No 1975) (6).

Descriptors: *Data processing, *Simulation analysis, *Optimization, *Computer programs, Data storage and retrieval.

Data management activities for the Texas Water Plan were developed to assist in data preparation for the system's simulation study. It provided the user with a problem-oriented and easily used set of computer programs for supplying most of the information required by the simulation and optimization programs. Four computer programs resulted: Curfit-I, Tapewrite II, Update I, and Portgen I. They functioned in a way designed to insure the proper generation of a single comprehensive tape file capable of supplying input to the simulation and optimization programs. The programs consisted of computer coded instructions that read data cards containing information prepared by the user on problem-oriented input data forms. The programs were used separately but could function as an integrated set of programs. All four programs were described in detail and mathematical descriptions were used. (See also W70-09511) (Kriss-Cornell)
W70-09516

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME IV - USERS MANUAL.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 091, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol IV - Users Manual, Aug 1969. 195 p, 16 fig. OWRR Project C-1377 (No 1975) (7).

Descriptors: *Computer programs, *Simulation analysis, *Optimization, *Data collection.

The Users Manual provided a reference document that describes how to use the following computer programs: Curfit I, Tapewrite II, Update I, Portgen I, SIM-I, SIM-II, Allocation Program and Stage Development Programs. The descriptions for each of the programs included: (1) statements of purpose; (2) explanation of capabilities, limitations, and assumptions; (3) presentation of problem-oriented input forms; (4) descriptions of the data required on the input forms; (5) discussion of the card sequencing requirements; (6) presentation of examples of printer output generated by each of the programs; and (7) a description of the contents of the common input tape file used with the SIM-I, SIM-II, Allocation and Stage Development Programs. The descriptions reflected the capability of the programs which were debugged and tested on the UNIVAC 1108 using a single comprehensive example problem. (See also W70-09511) (Kriss-Cornell)
W70-09517

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 092, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol V - Stochastic Demand Prog Descrip, Aug 1969. 48 p, 3 fig, append. OWRR Project C-1377 (No 1975) (8).

Descriptors: *Stochastic processes, *Computer programs, *Irrigation design, Agriculture, Demand, Synthetic hydrology, Runoff, Texas, Management, Simulation, Optimization.

The construction of a stochastic technique for the generation of areawide demands was investigated and recommendations for implementation of a resultant computerized procedure were presented. The study, by Dr. G. K. Young of Water Resources Engineering, Inc. represented a first attempt to develop a procedure to generate stochastic agricultural demands for irrigational water on a unit acre basis for prespecified cropping patterns, soil conditions, irrigation efficiencies and effective rainfall assumptions. The soil moisture accounting technique used by the Texas Water Development Board served as a comprehensive source of information concerning irrigation computations and predictions. It was concluded that a specially tailored version of the technique be employed, in conjunction with stochastic hydrology and an artificial data generator to calculate synthetic demands. An additional conclusion was that runoff data should be incorporated into the stochastic generating process. Stochastic hydrology and irrigation prediction techniques were synthesized by a two-step procedure to calculate synthetic demands. The stochastic procedures were developed in conjunction with the simulation and optimization programs but no attempt was made to insure their direct compatability with each other. (See also W70-09511) (Kriss-Cornell)
W70-09518

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME VI - RESEARCH ACCOMPLISHMENT AND COST SUMMARY.
Texas Water Development Board, Austin.

Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol VI - Research Accomp and Cost Summary, Aug 1969. 11 p, 1 fig, 8 ref, 1 append. OWRR Project C-1377 (No 1975) (9).

Descriptors: *Computer programs, *Costs, *Research, Water Resources planning, Texas, Water management (Applied), Scheduling.

A computer-oriented planning system for use in the planning of large, multi-basin systems of reservoirs and connecting river reaches and pump-canals of the proposed Texas Water System was summarized. Nine interrelated computer programs and the approach for using these programs were developed. They were of five types: Data Management Programs, Simulation Programs, Stage Development Programs, Allocation Programs, and Stochastic Demand Programs. The purpose of all five types and their corresponding subdivisions were reviewed. A detailed project schedule was given where the first significant step was taken in June of 1967. 'Conceptual approaches' to the solution of the water development problems in Texas were submitted by seven firms. A 'Consulting Panel' was formed by the Board that defined the framework of the needed research and provided guidance to the research staff. A Systems Engineering Group was created to provide for developing an 'in-house' capability of using results of the first year's research and to conduct future studies and complete the computer-oriented planning system by 1972. The specifications of the research project proposed for the fiscal year 1970 were given along with the estimated expenditures, a list of research education and publication benefits, and the research staff. (See also W70-09511) (Kriss-Cornell)
W70-09519

FINAL PROGRESS REPORT DELAWARE ESTUARY AND BAY WATER QUALITY SAMPLING AND MATHEMATICAL MODELING PROJECT.
Delaware River Basin Commission, Trenton, N.J.

Available from NTIS as PB-193 799, $3.00 in paper copy, $0.65 in microfiche. Delaware River Basin Commission, May 1970. 105 p, 10 tab, 27 fig, 10 ref. FWQA Project 16090 DCL...5/10.

Descriptors: *Mathematical models, *Dissolved oxygen, *Biochemical Oxygen Demand, *Pollution abatement, *Water quality, Water pollution, Oxygen sag, Organic wastes, Waste water treatment.
Identifiers: *Parameters of biochemical oxygen demand, Carbonaceous biochemical oxygen demand, Nitrogenous oxygen demand.

This is a report on a demonstration grant from the Federal Water Pollution Control Administration. The principal contents are comparisons of water quality parameters for the Delaware Estuary with those previously estimated for years ending 1963. Data on water quality were also obtained for a number of major pollution sources. Comparisons show that previous mathematical models for the Delaware Estuary can still be used to verify dissolved oxygen levels. Current levels of dissolved oxygen fail to meet the standards established by the Commission. It is stated that in the future, regulation of carbonaceous raw waste of industry and municipalities will be sufficient to meet these standards, but no basis for this prediction is outlined in the report. This report provides background for further analysis of economically feasible alternatives programs on the Delaware River. (Whipple-Rutgers)
W70-09526

MATHEMATICAL MODELLING OF WATER QUALITY CHANGES IN A RIVER BASIN,
Hydraulic Research Inst., Brno (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W70-09593

THE MATHEMATICAL MODELING OF A STRATIFIED ESTUARY,
Imperial Chemical Industries Ltd., Billingham (England). Heavy Organic Chemical Div.
For primary bibliographic entry see Field 02L.
W70-09607

OPTIMAL RESOURCE USE OVER TIME WITH AN APPLICATION TO GROUNDWATER,
California Univ., Davis.
For primary bibliographic entry see Field 02F.
W70-09649

OPTIMAL TAXING FOR THE ABATEMENT OF WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W70-09652

A NOTE ON THE RELATION BETWEEN BINARY AND MULTIPE CHOICE PROBABILITIES,
Presidency College, Calcutta (India); and London School of Economics and Political Science (England).
S. K. Chakrabarti.
Econometrica, Vol 37, No 4, p 726-727, Oxtober 1969. 2 ref.

Descriptors: *Probability, Mathematical studies.
Identifiers: *Binary choice, Ranking.

At the end of his classic paper, 'Threshold in Choice and the Theory of Demand.' Nicholas Georgescu-Roegen raised a significant problem. Namely, 'What axioms are logically necessary and experimentally justified, to relate the multiple choice probability to that of the binary choice.' In this note a simple ranking postulate is proposed as a possible answer to this situation. This article may prove of interest to the researcher in the water area concerned with mathematical models making use of the theory of probability in the context of threshold variables. (Loeb-Rutgers)
W70-09660

STOCHASTIC STABILITY OF SHORT-RUN MARKET EQUILIBRIUM: COMMENT,
Rutgers - The State Univ., New Brunswick, N.J. Bureau of Conservation.
E. Roy Weintraub.
Quarterly Journal of Economics, Vol LXXXIV, No 1, p 161-167, February 1970.

Descriptors: *Stability, *Equilibrium, Prices, Supply, Risks.
Identifiers: *Stochastic stability, *Market equilibrium, *Shocks, Discrete time model, Linear stochastic model, Walrasian stability, Marshallian stability, Random shocks, Dynamic analysis.

Comments are made on a recent article by Stephen J Turnovsky in which random disturbances were introduced into a cobweb model and which showed that stochastic parameters were crucial for the analysis of stochastic stability. This note shows that the techniques of stochastic stability analysis used by Turnovsky in the case of discrete time systems can be carried over to continuous time to generalize the usual Marshallian and Walrasian stability conditions. A second purpose of this note is to present briefly some salient features of stochastic stability theory. This may prove helpful in analyzing equilibrium and stability in the water resources area where the problem is analyzed via a cobweb model or via simple multiplicative and additive continuous time stochastic systems that reflect risk or uncertainty in the water demand and supply functions. (Loeb-Rutgers)
W70-09661

EXTERNALITIES AND OUTPUT TAXES,
Washington Univ., Seattle.
Lowell R. Basset, and Thomas E. Borcherding.
The Southern Economic Journal, Vol 36, No 4, p 462-464, April 1970. 1 fig, 5 ref.

Descriptors: *Taxes, Supply.
Identifiers: *Externalities, *Output, Inferior input, Short-run, Long-run, Output tax.

It is demonstrated that under widely used assumptions a tax on output will always cause a long-run reduction in the amount of the externality supplied by the industry whether the input producing the externality is inferior or normal to the firm. Further, the authors extend the analysis of an output tax to a general model, namely an n-input, competitive-market model with imperfectly elastic factor supply functions facing the taxed industry. In this case comparative statics results are not necessarily determinate; however, this ambiguity does not arise because of the presence of an inferior factor but because of the general problem of complementarity. This analysis may prove applicable to the water area when analyzing the effect on the externalities created by a water related industry when a tax is imposed upon the output of that industry. (Loeb-Rutgers)
W70-09666

FIRST ORDER CERTAINTY EQUIVALENCE,
California Univ., Berkeley.
E. Malinvaud.
Econometrica, Vol 37, No 4, p 706-718, October 1969. 7 ref.

Descriptors: *Risks, Probability, Value, Decision making.
Identifiers: *Certainty equivalence, Decision, Quadratic payoff, Dynamic problem, Instruments, Payoff function, Strategy.

The classical certainty equivalence theorem states that the optimal decision in a risky situation is the same as in some associated riskless situation. It holds true under rather specific conditions; quadratic payoff, and linear relations between instruments and results. When these conditions are not met but the various functions involved are differentiable, an approximate property can still be stated. The property is proved and discussed for the following well known dynamic problem: when information accumulates over time how should one choose the sequence of values to be given to some instruments. This paper may prove helpful to the theoretical problems in decision making in the water area. (Loeb-Rutgers)
W70-09667

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS: PART 2 - THE BROSNA CATCHMENT AT FERBANE,
Institute of Hydrology, Wallingford (England).
P. E. O'Connell, J. E. Nash, and J. P. Farrell.
Journal of Hydrology, Vol 10, No 4, p 317-329, June 1970. 13 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, Computer programs, Rational formula, Simulation analysis, Model studies, Hydrographs, Hydrograph analysis, Precipitation (Atmospheric), Runoff forecasting, Routing, Hydrologic budget, Water balance, Parametric hydrology.
Identifiers: Brosna watershed (Ireland), Ferbane (Ireland).

An attempt to model the runoff process on the Brosna catchment is described. The Brosna catchment covers some 458 square miles in the center of Ireland and drains into the Shannon. The catchment is very flat except where some glacial deposits provide some relief. Two lakes cover 10 square miles at the upper end of the catchment. The underlying carboniferous limestone is covered by boulder clay which supports grazing land and some peat bogs with a little woodland. There is no noticeable evidence of substantial groundwater movement across the topographical boundary. The model accounts for 80-85% of the initial variance. Interdependence among the parameters must be avoided if the optimum values of the parameters are to be well defined. Much better results could be achieved by further elaboration of the model. (Knapp-USGS)
W70-09698

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-09740

DYNAMIC PROGRAMMING AND ESTUARINE WATER QUALITY CONTROL,
Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 05G.
W70-09819

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09820

ON LINEAR PROGRAMMING IN A MARKOV DECISION PROBLEM,
Yale Univ., New Haven, Conn.
Eric V. Denardo.
Management Science, Theory, Vol 16, No 5, Jan 1970, p 281-288, 8 p, 20 ref. NSF Grant GK-13757.

Descriptors: *Markov processes, *Linear programming, *Optimization, Decision making, Planning, Analytical techniques.
Identifiers: Iteration algorithm, Choice.

Numerous water resources models incorporate Markow processes. An undiscounted Markov decision model with an infinite planning horizon was described. The model was analyzed by application of a linear program first proposed by Manne for a special case of the model. A brief description and comparison of a single-chain policy iteration routine with a complex multichain policy iteration algorithm which computed an optimal policy was given. It was shown that Manne's single-chain linear program found the ergodic chain that optimized the gain rate over all chains, regardless of chain structure. This solves optimization problems in which the decision-maker has his choice of policy and of starting state. It was then shown how to embed the single-chain program in a decision procedure that finds a gain maximizing policy efficiently in all cases, simple or complex. A Markov renewal programming model was introduced with finite states or regeneration points. A program to generalize Manne's program to the Markov renewal model was used as the primary tool in a procedure described for computing a gain optimal policy. A second program was considered which was analogous to linear programming for discounted Markov decision problems. (Kriss-Cornell)
W70-09821

A FRACTILE APPROACH TO LINEAR PROGRAMMING UNDER RISK,
Iowa State Univ., Ames. Dept. of Economics.
J. K. Sengupta, and J. H. Portillo-Campbell.
Management Science, Theory, Vol 16, No 5, Jan 1970, p 298-308. 11 p, 7 tab, 15 ref. NSF Project GS-1810/420-21-17.

Descriptors: *Linear programming, *Risles, Theoretical analysis, Stochastic processes, Optimization, Variability, Probability, Profit.
Identifiers: Computational analysis, Empirical analysis, Fractile criterion.

The implications of a fractile approach to linear programming under risk through maximizing a given fractile of the distribution of profits under linear programming restrictions were examined both theoretically, computationally and empirically. In recent years the water resources linear programming models have increasingly incorporated concepts of risk and uncertainty through the various approaches of probabilistic programming; e.g., chance-constrained programming stochastic programming etc. An investigation of the implications of some of the simple methods of risk programming using three optimization criteria, e.g., expected value, the fractile and the portfolio criterion was given. In the expected value criterion

the expected profit level was maximized, whereas the portfolio criterion minimized (i.e. variability) of total profit subject to some minimum expected profit. The fractile criterion sought to maximize the alpha-fractile of the cumulative probability distribution of profits with the value of alpha preassigned by the decision maker. Advantages of the fractile criterion applied to linearprogramming problems under risk were illustrated and the approach was discussed under the assumption that the profit function was normally distributed. (Kriss-Cornell)
W70-09822

EXPERIMENTAL DESIGNS FOR COMPUTER SIMULATION EXPERIMENTS,
Princeton Univ., N. J.; and Duke Univ., Durham, N. C.
J. S. Hunter, and T. H. Naylor.
Management Science: Theory, Vol 16, No 7, March 1970, p 422-434. 13 p, 1 fig, 2 tab, 31 ref.
NSF Grant GS-1926.

Descriptors: *Simulation analysis, *Computer program, *Mathematical models, Design, Optimization, Analytical techniques.
Identifiers: Practical problems.

Within the context of two simulation experiments with an inventory model, the paper discussed factorial, franctional factorial, rotatable, and response surface designs. Careful attention to experimental design questions prior to conducting a simulation experiment was given. Experimental designs were available for: (1) investigating the relationship of the response to the factors in order to determine the underlying mechanisms governing the process under study and (2) finding the combination of factor levels at which the response variable is optimized. These designs were not only economical but provided a structure for the investigator's learning process. A full description of a simulation model was given and the following four activities were described: formulation of a computer program, validation, experimental design, and analysis of simulated data. An example model was used and two different types of simulation experiments were described - an explanatory model and an optimization model. A number of practical problems which arise in designing simulation experiments were described as the problem of sample size, the multiple response problem, the problem of nonlinearity, the problem of convergence, and the problem of constrained optimization has application to water resources simulation modeling. (Kriss-Cornell)
W70-09823

EFFECT OF THREE VOTING RULES ON RESOURCE ALLOCATION DECISIONS,
Pittsburgh Univ., Pa. Graduate School Business.
Jacob G. Birnberg, Louis R. Pondy, and C. Lee Davis.
Management Science: Application, Vol 16, No 6, Feb 1970, p B356-372. 17 p, 8 tab, 25 ref.

Descriptors: Resource allocation, Decision making, Budgeting, Capital, Laboratory tests, Model studies, Variability.
Identifiers: Voting rules.

The effect of the voting rule adopted by a capital budgeting committee on the allocation of resources among divisions was examined. The results of a laboratory experiment indicated that different voting rules have different characteristics measured in terms of the size of the total budget allocation made and the interdivision variability. In addition, an attempt was made to ascertain the techniques used by the groups to reach a decision. Four possible models were developed: the random choice model, the long run cooperative model, the short run competitive model, and the gaming model. None of the four models offered provided an adequate explanation of the observed behavior. However, a mixed model consisting of two of the approaches did provide a reasonable explanation for the observed behavior. (Kriss-Cornell)
W70-09824

A SIMULATION MODEL OF CAPITAL BUDGETING UNDER UNCERTAINTY,
Texas Univ., Austin.
Rodolfo Salazar, and Subrata K. Sen.
Management Science: Application, Vol 15, No 4. Dec 1968, p B161-B179. 19 p, 7 fig, 5 tab, 24 ref.

Descriptors: *Simulation analysis, Capital costs, *Budgeting, Investment, *Stochastic processes, *Linear programming, *Risks, Mathematical models, Management, Constraints.
Identifiers: Weingartner's Basic Horizon model.

A simulation model of capital budgeting under uncertainty is described. It analyzed the effects of two types of uncertainty which influence the cash flows of the potential investment projects. Techniques of simulation and stochastic linear programming (using Weingartner's Basic Horizon model of capital budgeting) were employed to compute the expected return (with an associated measure of the risk involved) of different portfolios of projects. The manager could then select the portfolio which was closest to his personal risk-return preference. The model provided a practical guide to management in the entire process of project search, portfolio generation, and portfolio evaluation which characterizes the capital budgeting decision. Several formal mathematical programming techniques recently proposed for handling uncertainty were mentioned: Stochastic linear programming, linear programming under uncertainty and chance-constrained programming. The approach taken in this paper utilized concepts of decision trees simulation, and stochastic linear programming. Has numerous applications to water resources capital budgeting problems. (Kriss-Cornell)
W70-09826

AN APPROACH TO LINEAR PROGRAMMING WITH 0-1 VARIABLES,
Keio Univ., Tokyo (Japan).
Shiyuo Senju, and Yoshiaki Toyoda.
Management Science: Application, Vol 15, No 4, Dec 1968, p B196-B207. 12 p, 7 fig, 6 tab, 2 ref, 1 append.

Descriptors: *Linear programming, *Variability, *Decision making, *Optimization, Mathematical models, Profit.
Identifiers: Integer programming.

Not infrequently water resource planning alternatives are presented as fixed; i.e., a project is to be built to its specified capacity or not at all. The article presented a simple approach to obtaining approximate solutions to decision making problems in which one seeks to choose the optimal package from a large number of indivisible independent proposals. The fundamental concept was to make some ordinal scales among proposals. Steps of calculation were illustrated by examples of choosing the optimal mix of orders, one of which involved 60 candidate proposals with 30 restricting conditions. The problem was formulated in mathematical terms and was a special case of the interger programming problem often called the 'Knapsack Problem'. A simple numerical example was used to illustrate the problem of choosing the optimal package of orders so as to maximize the total profit, with an order either fully accepted or not accepted with no in-between condition. A two-dimensional vector notation expressed the relations between proposed orders and limiting conditions. Improvements of the procedure and some generalizations were made. An example with four restricting conditions and a large scale example were also given. The advantages of the method were presented in the conclusion. (Kriss-Cornell)
W70-09827

MARKOV CHAINS AND EMBEDDED MARKOV CHAINS IN GEOLOGY,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
William C. Krumbein, and Michael F. Dacey.
Report available from NTIS as AD-704 748, $3.00 in paper copy, $0.65 in microfiche. Northwestern University, Department of Geological Sciences Technical Report No 12, April 1970. 18 p, 42 ref. ONR Contract No NR 389-150 and 389-153.

Descriptors: *Hydrologic data, *Data processing, *Statistical methods, *Markov processes, Stochastic processes, Statistics, Mathematical studies, Simulation analysis, Synthetic hydrology, Geology, Hydrology, Data collections, Bibliographies, Reviews, Stratigraphy, Sedimentation.
Identifiers: Geological data.

Geological data are structured as first-order, discrete-state discrete-time Markov chains in two main ways. In one, observations are spaced equally in time or space to yield transition probability matrices with nonzero elements in the main diagonal; in the other, only state transitions are recorded, to yield matrices with diagonal elements exactly equal to zero. The mathematical differences in these two approaches are reviewed here, using stratigraphic data as an example. Simulations from chains with diagonal elements greater than zero always yield geometric distributions of lithologic unit thickness, and their use is recommended only if the input data have the same distribution. For thickness distributions lognormally or otherwise distributed, the embedded chain is preferable. The mathematical portions of this paper are well known, but are not readily available in publications normally used by geologists. One purpose of this paper is to provide an explicit treatment of the mathematical foundations on which applications of Markov processes in geology depend. (Knapp-USGS)
W70-09848

MARKOV CHAIN MODELS OF TURBULENT DIFFUSION,
Cambridge Univ. (England). Cavendish Lab.
For primary bibliographic entry see Field 02E.
W70-09860

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
Richard M. Males, William E. Gates, and Junius F. Walker.
Available from NTIS as PB-194 335, $3.00 in paper copy, $0.65 in microfiche. Engineering-Science, Research and Development, Final Report, May 1970. 44 p, 11 fig. OWRR Project C-1496 (no. 1989).

Descriptors: *Decision-making, *Behavior, *California, *Administrative decision, *Water quality control, *Simulation analysis, *Systems analysis, *Social change.
Identifiers: *Enviromental system dynamics, *Dynamics of social systems, *Industrial dynamics, *Behavioral science.

Techniques of behavioral science and systems analysis were utilized to analyze the internal decision-making structures of the Regional Water Quality Control Board of California. The Board was treated as a three-component entity which responds dynamically to information inputs from pressure groups. The decision-making process was taken as consisting of functional areas: (1) generation of pollution; (2) perceived level of actual pollution; (3) desired level of water quality; (4) desired rate of adjustment between existing and desired quality; (5) negotiation of response between interest groups. Based on the above framework, a computer simulation model of the decision-making process was developed. Data for the model were obtained from partially structured interviews and from case studies. The model is capable of characterizing behavior of the decision-making process as a function of a number of physical and behavioral

parameters. Informal, rather than formal objectives govern the operation of the Board. The regional board system of California is effective insofar as it can achieve cooperation on the part of those dischargers holding strong vested interests in the area. Long delays between problem identification and resolution are inherent in the system.
W70-09908

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMICA BAY,
Rand Corp.
For primary bibliographic entry see Field 05D.
W70-09937

6B. Evaluation Process

LAKE MICHIGAN BASIN STUDY: MICHIGAN SECTION.
League of Women Voters of Michigan, Detroit.

Available from the League of Women Voters of Michigan, 4612 Woodward Ave, Room 317, Detroit, Michigan, 48201. Price-30 cents. League of Women Voters of Michigan, Detroit, Michigan, January 1968. 36 p, 1 dwg, 17 ref, (Mimeographed).

Descriptors: *Lake Michigan, *Michigan, *Administrative agencies, *Hydrology, *Geology, *Water resources development, *Water supply, *Pollution abatement, *Flood control, *RIrrigation, *Navigation, *Watershed Protect. and Flood Prev. Act, *Recreation, *Fish, *Wildlife.
Identifiers: *Western Michigan Lake Shoreline, *Upper Peninsula-Eastern Area, *Lower Peninsula-Northwestern Area, Act 253.

The Michigan section of the Lake Michigan is described in terms of physical characteristics and water-related activities. Geological and hydrological conditions are reviewed including information regarding lake current, lake levels, water quality, tributary streams in Michigan and aquatic life. In 1960 there were more than 2.5 million people in this section of Lake Michigan. The economy of the basin is considered in three areas: Western Michigan Lake Shoreline, Upper Peninsula-Eastern Area, and Lower Peninsula-Northwestern Area. Agriculture, and to a lessening degree logging, have dominated the basin as a whole; the use of Lake Michigan water for irrigation has been of little significance. Water supply for approximately 650,000 comes from Lake Michigan. Principal sources of water supply are listed as are state and federal agencies with responsibilities in this connection; it is concluded that groundwater is being depleted faster than it is being replenished. A variety of pollution sources and efforts at abatement are reviewed. Included is discussion of sanitary disposal systems, industrial waste, large and small craft, and appropriations. Magnitude of flooding and projects and agencies dealing with it are listed; the same is done for irrigation. Power generation using hydroelectric coal-fired, and eventually nuclear steam generation systems is discussed with reference to its effect on water. Commercial navigation has been and will continue to be of great significance to the area; discussion of eight harbors is given. Watershed projects stemming from Act 253 and PL 566 are indicated. Finally listed are facilities and available resources for boating, camping, fishing and hunting. (Preckwinkle-Chicago)
W70-09622

LAKE MICHIGAN BASIN STUDY-ILLINOIS SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.

League of Women Voters, Chicago, 1968. 31 p. (Mimeographed).

Descriptors: *Lake Michigan, *Illinois, *Water resources development, *Water utilization, *Pollution abatement, *Administration, *Geology, *Flood control, *Recreation, *Navigation, *Irrigation, *Watershed management, Electric power.
Identifiers: *Chicago, Geography, Illinois Sanitary Water Board, Chicago Water Board, Metropolitan Sanitary District, Northeastern Illinois Planning Commission, North Shore Sanitary District, Lake diversion.

The Illinois section of the Lake Michigan basin is described with summaries of geological and geographical characteristics of the area. Efforts at pollution abatement, flood control, irrigation and water use in power generation and recreation are discussed, and finally outline of administrative organization, navigation, watershed management, and international and interstate commissions is made. The Chicago area's effect is emphasized because of its great population concentration and the problems which arise with regard to water supply, transportation, and waste disposal. Limitations on lake diversion serve as an example here. Indicated as especially important are the Sanitary Water Board, the Chicago Water Board and the Metropolitan Sanitary District along with an advisory agency, the Northeastern Illinois Planning Commission. A study of water supply needs published by this latter agency is reviewed with projections for each of the six counties included. Pollution abatement efforts directed toward the North Shore Sanitary District and industrial polluters are discussed as are the efforts of a number of federal and interstate agencies and state agencies. The magnitude of the flooding problem is discussed with reference especially to sewer overflow. With regard to recreation, federal agencies' responsibilities are summarized. Because of the numerous local, regional, and state agencies concerned with water resources development, an effort is also made to summarize their responsibilities. Navigation is reviewed in terms of facilities and pollution problems. Watershed management problems are indicated and practices and programs to deal with them mentioned. Finally described are five commissions dealing with interstate and international concerns. Preckwinkle-Chicago
W70-09623

LAKE MICHIGAN BASIN STUDY: WISCONSIN SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.

League of Women Voters, Wisconsin, 1968. 10 p, 11 ref. (Mimeographed).

Descriptors: *Lake Michigan, Wisconsin, Geology, Population, Water resources development, Legislation, Water supply Pollution abatement, Flood control, Electric power, Irrigation, Navigation, Watershed management, Industrial wastes, Sewage treatment, Pulp wastes, Fishing, Wildlife.
Identifiers: *Northeastern Wisconsin, Southeastern Wisconsin, Milwaukee, Green Bay.

The Wisconsin section of the Lake Michigan basin is described with brief summaries of physical characteristics, population characteristics, economic characteristics and water related activities and characteristics. Included are descriptions of water supply, pollution abatement, flood control, power generation, irrigation, navigation, watershed management, recreation, fish and wildlife. Because of regional differences the northeastern and southeastern sections of Wisconsin are considered separately. The northeastern section centers around Green Bay. Population in this section is expected by 2020 to nearly double the 1960 level of 778,000. Principal occupations are listed and because of the importance of lumber the waste load from pulp and paper is an important contribution to pollution. The southeastern section has a population of 1,674,000 and with a 59.9 increase expected between 1963 and 1990 it is one of the nation's fastest growing large metropolitan regions. Six major and five minor watersheds are listed with groundwater as contributing to the water supply. Irr[illegible] much of the region, flooding is a recurring problem[illegible] and with continued urbanization this is expected to[illegible] increase. Approximately 59 of urban developed[illegible] area is served by facilities from Lake Michigan.[illegible] Commercial shipping, confined to the Milwaukee[illegible] Harbor area, is described as are recreational areas.[illegible] State control of water resources brought about by[illegible] 1966 legislation is discussed. Finally, the work of[illegible] Southeastern Regional Planning is reviewed. In-[illegible] cluded is a statement from the agency pinpointing[illegible] municipal sewage plants as the most important[illegible] sources of pollution in the region. (Preckwinkle-[illegible] Chicago)
W70-09624

LAKE MICHIGAN BASIN STUDY: INDIANA [illegible] SECTION-1.
League of Women Voters, Detroit, Mich. Lake [illegible] Michigan Inter-League Group.

League of Women Voters, Indiana, 1968. 9 p, 1 [illegible] map, 5 ref. (Mimeographed).

Descriptors: *Lake Michigan, *Indiana, *Geology, [illegible] *Population, *Water resources development, [illegible] *Water supply, *Pollution abatement, *Electric [illegible] power, Navigation, Administration, Watershed [illegible] management, Recreation, Flood control, Irrigation, [illegible] Industrial wastes, Sewage treatment.
Identifiers: *Lake Michigan basin, *St. Joseph river basin, Burns Ditch, Indiana Dunes.

The Indiana section of the Lake Michigan basin is described with summaries of physical characteristics, population, and economy. Groups active in water resources development are listed and discussion given to water supply, pollution problems, flooding, irrigation, power generation, navigation, watershed management, and recreation. In addition to the Lake Michigan basin, the St. Joseph river basin is included because of its indirect concern with the lake. The Lake Michigan basin is of glacial composition with northerly drainage and topographical conditions producing creeks and small rivers. A number of these are described along with Burns Ditch construction. Greatest population is in northern Lake County with Primary Metal Industries employing 61.9% of the regions industrial workers. Water supply is judged to be adequate for some time with open water of Lake Michigan of excellent quality. Industrial wastes, municipal sewage and combined sewer overflows are principal pollution sources; the quality of major lakes, harbors, and rivers in the region is reviewed. Flooding is of limited importance and irrigation even less. Steam generation and the possibility of nuclear energy are closely related to water as is navigation especially with large industry. Watershed and recreation plans are reviewed with the Indiana Dunes especially important. Although less dense, the St. Joseph River with 408,130 in 1960 was almost two thirds as populous as the Lake Michigan basin. With numerous lakes, rivers and water at shallow depths water supply is no problem. Plans, criteria and standards regarding sewage treatment are reviewed; analyses have indicated poor river conditions at times. Although there are several dams in the region, most power is from fossil fuel with steam generation. (Preckwinkle-Chicago)
W70-09625

POLITICAL AND SOCIAL ACCOMMODATION AS A BASIC ELEMENT IN PLANNING.
Colorado State Univ., Fort Collins.
Norman Wengert.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John A. Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 55-71. 1 ref.

Descriptors: *Planning, *Administration, Social values, Attitudes, Political aspects.
Identifiers: *Political accommodation, *Social accommodation, Goals, Policy.

The need to approach political and social accommodation from a new viewpoint is enphasized. The concept of accommodation in planning has typically been approached from a negative viewpoint; i.e., accommodation implied non-rational action. Accommodation is seen in terms of flexibility of planning, the recognition of wider interests and views, and innovative planning. Planning can be thought of representing a kind of rationality in relating ends (a complex goal and value structure) to means, with the stress upon instrumental rationality and not on absolute sets of principles or conclusions. Motivation is also discussed as a factor stressing the need for accommodation in planning. Motives for executing a particular public program tend to be quite heterogeneous, a fact often overlooked by officials deeply involved in programs, who tend to think of public support as being unitary and with a single motive. A final consideration is the need to relate planning in the theoretical and conceptual sense to the realities of the democratic system. Problems such as different community goals in different social groups, disenfrancisement of minority groups, and lack of public institutions formulate and articulate public goals. (See also W70-09627). (Davis-Chicago)
W70-09626

COMPREHENSIVE WATER RESOURCE PLANNING: THE NEW APPROACH.
North Carolina Univ., Chapel Hill.
Maynard M. Hufschmidt.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 97-113.

Descriptors: *Planning, *Water resources, *Methodology, River basin development, Economic efficiency, Urbanization, Inter-agency cooperation.
Identifiers: *Comprehensive water resource planning, Economic development, Political equity, Environmental quality, Multi-sector planning.

Six major points regarding the status of comprehensive water resource planning are made. First, the present pattern of comprehensive river basin planning is not obsolete in many important respects. Second, the historical preoccupation with economic development as a rationale for water resource undertakings is much less important today than it once was. Third, in terms of plan formulation and analysis, the past concern for ecenomic efficiency as the single most important objective is being displaced by a concern for a broader set of objectives, e.g., equity and environmental quality. Fourth, the scale, scope, and content of water resource planning activities today are to some extent inadequate and obsolete, failing to deal with urban-metropolitan and urbanizing areas. Fifth, water resource planning must increasingly be carried out in a context of multi-sector planning. Sixth, water resource agencies must develop new patterns of working relationships with state and local agencies and with other federal agencies and programs. (See also W70-09629). (Davis-Chicago)
W70-09628

WATER RESOURCES PLANNING IN A METROPOLITAN NATION.
Georgia Inst. of Tech., Atlanta.
Guy J. Kelnhofer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 185-190.

Descriptors: Urbanization, *Planning, Cities, Decision making, Political aspects, Water quality, Aesthetics, Institutions, Institutional constraints.
Identifiers: *Metropolitan water resource management, *Water resource planning, Metropolitan areas.

The United States has become an urban nation. As a result, the traditional governmental machinery and the set of assumptions and values which underlie it may not be applicable to the conditions of life in the modern metropolis. As a result, many new demands are being made upon water resources planning. First, a new measure of public investment decisions is how it affects people; and in what people can participate in the decision-making process. Second, urban interests rather than rural interests are the focus for water resources planning. Third, new considerations of water use are rising to prominence, considerations of quality and aesthetics. Fourth, change, flexibility, and responsiveness have become critical criteria in the public's evaluation of its management systems. Finally, agencies, such as the Corps of Engineers, will have to develop the ability to meet change confidently. To achieve this adaptability it is necessary to develop a highly-sensitive and smoothly-functioning internal planning capability. (See also W70-09630). (Davis-Chicago)
W70-09629

CHALLENGES OF THE URBAN METROPOLITAN ENVIRONMENT TO THE WATER RESOURCES PLANNER.
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 191-201. 13 ref.

Descriptors: *Planning, *Water resources, *Urbanization, Cities, Education, Multiple purpose, Research and development.
Identifiers: *Metropolitan water resource management, Urban environment, Regional integration, Comprehensive planning, Chicago, Muskegon County, Michigan, Little Calumet River.

Three basic concepts are discussed in attempting to provide a basis for this discussion of metropolitan water resource management. First, metropolitan areas are defined as sociological units embracing the central city and the surrounding urban sprawl. Second, the potential roles of water resource planners are described. A planner's role is a multiple one: he can be an educator and provide technical assistance; he can be a catalyst, and imaginatively trigger programs and developments, some of which are usually thought of to be unrelated to water resource management; and he can be the manager, taking sole responsibility for managing water with very little influence from anyone else. Third, metropolitan water resource management is described by a set of characterizing concepts: public-private involvement, multi-purpose planning, multiple means programs, research to keep abreast of technological and social change, techniques of regional integration, and the incorporation of water resources planning into comprehensive planning. Three case studies are used to illustrate how water planning can be related to the urban picture: the Chicago deep tunnel project, the Little Calumet Basin, the Muskegon County, Michigan waste water plan. (See also W70-09631). (Davis-Chicago)
W70-09630

PROBING THE RELATIONSHIPS BETWEEN THE CHARACTERISTICS OF SOCIAL AND PHYSICAL SYSTEMS,
Colorado State Univ., Fort Collins.
Duane W. Hill, and Charles L. Garrison.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 219-234. 1 ref.

Descriptors: *Methodology, Social needs, Social aspects.
Identifiers: *Interdisciplinary studies, Social system, Physical system.

Attention is focused on a search for ways of obtaining better quality information which can be used to generate more adequate answers to pressing questions. A basic difficulty has been the isolation of the various physical science and social science disciplines from each other. Consequences which changes in the physical system may have for the social system, and vice-versa, remain largely outside the purview of scientific investigation. The state of the interdisciplinary art is discussed emphasizing the interdisciplinary needs of social science. Several characteristics of social investigators are analyzed including: non-technical and non-scientific character, non-systematic and impressionistic techniques, non-functional descriptive orientations, low interest and low skills in sophisticated data collection, and progress toward scientific development. The interdisciplinary researcher will find that the descriptive yields of the social analysts are the most plentiful and ready for use. He will also find that a solid basis for experimental investigation has been laid, and if that basis is developed thoughtfully and carefully, it will yield a highly useful body of information. (See also W70-09632) (Davis-Chicago)
W70-09631

COMMUNITY EDUCATION FOR PARTICIPATION IN WATER RESOURCE PLANNING,
San Mateo Coll., Calif.
J. William Wenrich.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 235-246. 3 ref.

Descriptors: *Planning, *Education, *Water resources, *Decision making, Communication, Social values.
Identifiers: *Water resource planning, *Citizen participation, Susquehanna River Basin Project, Public hearing procedure.

A basic problem in water resource planning is the meaningful involvement of local interests in the planning process and decision making regarding planning. The problem is complicated by the increasing technical complexity of the decisions to be made. Also, ther is often a failure to distinguish effectively between technical decisions and value judgments. Existing techniques, notably the public hearing procedure, have failed in many instances to develop meaningful public participation in the planning of water resource development. Meaningful citizen participation in water resource planning decisions depends on establishing more effective means for two-way communication between water resource agencies and the public during the planning process. Research in this direction is described utilizing the Susquehanna River Basin Project as a case study. (See also W70-09633) (Davis-Chicago)
W70-09632

THE IRON LAW OF ENVIRONMENTAL DISORDER: A PESSIMISTIC NOTE ON COMPREHENSIVE PLANNING,
Colorado State Univ., Fort Collins.
John A. Straayer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 247-255. 7 ref.

Descriptors: *Planning, *Decision making, *Environment, *Methodology, Political aspects, Social aspects.
Identifiers: *Comprehensive planning, Environmental disorder, Environmental problems.

Comprehensive environmental planning has to do with devising methods and arrangements for controlling large portions of the environment. Given this definition, it is argued that comprehensive environmental planning is impossible. Emphasis should be placed on various levels of short term, lo-

calized and incremental muddling. There is an 'Iron Law' affecting decision making in the American political system which precludes effective solution of large scale environmental problems. Four interacting factors underlie this theory of environmental disorder: (1) the existence of multiple decision centers in the American political system; (2) the nature of contemporary environmental problems; (3) the nature of decision making in situations where demands outstrip resources; and (4) an ideology which supports local and decentralized decision-making prerogatives. As long asthese factors continue to exist, decisions which preclude comprehensive environmental planning will continue to be made. (See also W70-09626) (Davis-Chicago)
W70-09633

THREE APPROACHES TO ENVIRONMENTAL RESOURCE ANALYSIS,
Harvard Univ., Cambridge. Landscape Architecture Research Office.
Raymond K. Belknap, and John G. Furtado.
Available from the Conservation Foundation, Washington, D.C., 20036, Price: $2.00. Washington, D.C., Conservation Foundation, November 1967. 102 p, 21 fig, 43 ref.

Descriptors: *Planning, *Land management, *Land resources, *Land management, *Optimum development plans, Ecology, Multiple-purpose projects, Natural resources, Resource development.
Identifiers: Environment resource analysis.

This study selected three outstanding approaches developed to identify, analyze, and evaluate the natural and man-made resources that make up the physical environment and to outline their procedures. The three approaches examined are those expounded by G. Anous Hills, Philip H. Lewis, and Ian L. McHarg. More particularly, the study examined: (1) How the three individuals identified environmental and spatial patterns beyond single-factor analysis and simple spatial location; (2) how they identified and evaluated the key elements and forces that lend quality to the physical environment; (3) how they reviewed the analysis material for incorporation into the planning process; and (4) whether they treated environment as a resource per se or only in terms of the given planning purposes. (Davis-Chicago)
W70-09636

WATER PROBLEMS,
Geological Survey, Menlo Park, Calif.
H. E. Thomas.
Water Resources Research, Vol 1, No 3, p 435-445, Third Quarter 1965. 11 p, 2 tab, 14 ref.

Descriptors: *Water resources, Legal aspects, Political aspects, Technology, Environment, Constraints, Storage, Flow, Attitudes, Benefits, Costs, Management.
Identifiers: *Water problems, Physical constraints, Cultural constraints, Customs, Technological constraints, Socioeconomic problems, Economic constraints.

Man's effort to adapt to or modify his environment has generated water problems. As a first approximation the author classifies the constraints that cause these problems as follows: (1) Physical constraints, caused by the environment, specifically as it affects the storage and flow of water; (2) cultural constraints, resulting from customs and mores; (3) technological constraints, resulting from man's varying ability to modify his environment; (4) economic constraints, resulting from comparison of the benefits that may be received from water with the cost of realizing these benefits. Economic constraints become significant where there is choice among several alternatives of action. For example, choices must be made by administrators and consumers of water supplies as water becomes a scarce commodity in places where it had been previously abundant. Economic constraints may dictate the allocation of funds and other resources to water development. (Loeb-Rutgers)
W70-09648

THE THERMO-ECONOMICS OF SEA-WATER CONVERSION,
California Univ., Los Angeles.
Myron Tribus, and Robert Evans.
Water Resources Center Contribution No 61, Rept 62-53, 1963. 241 p, 44 fig, 21 tab, 32 ref, 8 append.

Descriptors: *Costs, *Fresh water, *Sea water, Technology, Flash distillation, Thermodynamics, Velocity, Conductors, Heat, Condensers, Vapor compression distillation, Freezing, Electrodialysis, Reverse osmosis, Equipment.
Identifiers: *Sea-water-conversion, *Optimum energy-technique, *Thermo-economics, Cost equation, Basic unit costs, Primary unit costs, Brine recycling, Load factor, Nonlinear systems, Conductance, Information theory, Multi-effect distillation, Solar energy, Available energy costs, Equipment costs, Expected value.

In this report, the economic and technological aspects of saline-water demineralization are set forth in concise form as they appear in the light of an intensive study of the underlying principles of thermodynamics and economics. These principles are digested into a compact technique which the authors call the 'optimum-energy-technique.' The optimum-energy-technique promises to be a faster, simpler, and surer method of studying and optimizing sea-water-conversion systems relative to other methods in current use. Application of the optimum-energy technique are given in this report for the following saline-water demineralization processes: multistage flash distillation, multi-effect distillation, vapor compression distillation, freezing, electro-dialysis, reverse osmosis, solar energy, and low-temperature-difference distillation. The optimum-energy-technique shows the relative importance of the many technological factors of sea-water conversion primarily according to their effects on two critical unit costs; the costs of available-energy and equipment, and the equipment conductance cost. The expected value of the latter cost may be used for judging the merits of various research proposals. The optimum-energy-technique should, via illuminating the combined economic and technological aspects of sea-water conversion, prove to be useful for planning or appraising systems of sea-water rectification. (Loeb-Rutgers)
W70-09653

NEW DIMENSIONS FOR TRANSNATIONAL MARINE RESOURCES,
Resources For the Future, Inc., Washington, D.C.
Francis T. Christy.
American Economic Review Vol LX, No 2, p 109-113, May 1970.

Descriptors: *Oceans, *Water resources, *Management, *Economic aspects, Continental shelf, Ocean circulation, Sea water, Water law, Fishing, Mining, Capital, Labor, Costs, Prices, Economic feasibility, Fisheries, Conservation, Economic impact.
Identifiers: *Exclusive rights, *property rights, Economic systems.

The author feels that the growing value of marine resources and the increasing incentive of nations to appropriate these resources makes the oceans a potential source of major conflict between states. Social scientists have an important role to play in the formulation of new rules and institutions governing the appropriation of the sea's resources. The paper studies the differences between resources of land and those of the sea. It is impossible to assign exclusive rights to the sea or to control the amounts of capital and labor applied to the resource. In the exploitation of the sea's resources there is a confrontation between economic units operating under different wage/price structures and different value systems. The difficulty of managing the sea's resources is explained as well a the problems posed by the occurrences of th resources in three dimensional space. The pape concludes with a statement stressing the urgency c an early solution to these problems. (Murphy-Ru gers)
W70-09655

INTRODUCTION TO THE ECONOMY ANN CHARACTER OF THE WABASH BASIN,
Iowa Univ., Iowa City.
Ronald R. Boyce.
In: Regional Development and the Wabash Basin, p 9-45, University of Illinois Press, Urbana, 1964. 13 fig, 11 tab.

Descriptors: *Water resources, *Flood damage Economics, Industries, Population, Employment Water quality, Water utilization, Demand, Naviga tion, Recreation, Benefits, Costs.
Identifiers: *Wabash Basin, Urban activities, Traf fic density, Water problems, Flood prevention.

This paper discusses general problems in the Wabash Basin, population characteristics, basic urban activities, and water resources. The discus sion of the water resources of the Basin would be of interest to the water researcher in this area as well as other areas of the US. The author presents possible development plans for the area in addition to the navigational and recreation use of the water. Recreation appears to be a major water resource benefit which would be drived from water impoundments in the Wabash Basin. Flooding is a major water problem and presents a major reason for water resources development. However, the values of the many possible benefits from a water impoundment can only be determined by an investigation of potential water benefits and concomitant costs. Flood prevention measures and a discussion of future study needs conclude this paper. (See also W70-09657) (Loeb-Rutgers)
W70-09656

INDUSTRY AND WABASH BASIN DEVELOPMENT,
Illinois Univ., Urbana.
Howard G. Roepke.
In: Regional Development and the Wabash Basin, p 59-78, University of Illinois Press, Urbana, 1964. 11 fig, 1 tab.

Descriptors: *Industries, Economics, Maps, Employment.
Identifiers: *Wabash Basin, *Development, Economic growth, Manufacturing, Industrial development.

This paper presents a consideration of the role of manufacturing in the economy of the Wabash Basin. Industry is one of the leading means of support for the Basin, and it is likely that much of the opportunity for future economic growth lies in this field. The analysis in this paper takes two forms. First, largely by the use of maps, the present extent, distribution, types, and growth of industry in the Basin is examined. This illustrates the extent to which industrial development has already taken place. Second, as the Basin is not a completely self-contained unit, certain trends affecting manufacturing in the United States as a whole and their possible effect on further development in the Wabash Basin are presented. This information might be relevant to other river basins where multi-level economic development plans are under investigation. (See also W70-09658) (Loeb-Rutgers)
W70-09657

RECREATION AND WABASH BASIN DEVELOPMENT,
Illinois Univ., Urbana.
Alfred W. Booth.
In: Regional Development and the Wabash Basin, p 79-88, University of Illinois Press, Urbana, 1964. 1 fig, 1 tab.

Descriptors: *Recreation, Recreation demand, Regions, Demand, Planning, Recreation facilities.
Identifiers: *Wabash Basin, Regional development, Recreation development.

Modern programs of regional development, particularly those which are water-oriented, are giving increasing attention to outdoor recreation. This is a response to a demand created by a mobile, wealthy society, with much free time, which has come to regard opportunities for outdoor recreation as a necessary ingredient in a 'better way of life.' Thus, any area or regional development program today must plan to satisfy this need. Furthermore, if the region has the potential, the planning program should also include provisions for capitalizing on these assets by planning for recreation-centered economic activity. The Wabash Basin is in the category of regions in which there is not only a strong demand for recreation activity, but in which there is also a potential for recreational development which could satisfy regional needs as well as forming the basis for, at least, a modest recreational industry serving an extraregional market. (See also W70-09659) (Loeb-Rutgers)
W70-09658

SOME OBSERVATIONS ON THE BUDGET CONCEPT,
National Planning Association, Washington, D.C.
Gerhard Colm, and Peter Wagner.
Review of Economics and Statistics Vol 65, No 2, p 122-126, May 1963.

Descriptors: *Budgets, *Economic evaluation, *Decisionmaking, Government, Financing, Forecasting, Planning, Debt, Management, Costs, Benefits, Capital costs.
Identifiers: *Program analysis, *Financial analysis, *Program Budget, Capital Budget.

Various budget concepts are analyzed in the light of the different purposes a budget must serve. The National Budget in particular is dealt with but relevancy exists for the water resources area because observations on the different types of budgets needed for different purposes are applicable to any program subject to rigorous analysis. The author distinguishes three purposes of a budget; program analysis, financial analysis and economic analysis. For these purposes there is a need for a program budget, a statement of cash receipts and payments, and a national economic budget. The first type of budget is of most importance in water resources and the author discusses those characteristics of this budget that would increase the quality of decision making and provide a more efficient allocation of resources. (Murphy-Rutgers)
W70-09663

ON DIFFERENT METHODS FOR ALLOCATING RESOURCES,
Yale Univ., New Haven, Conn.
Martin Shubik.
Kyklos Vol XXIII, Fasc 2, p 332-337, 1970.

Descriptors: *Prices, *Resources, *Economic evaluation, *Distribution, Government, Economic efficiency, Resource development, Taxes, Costs, Resource allocation, Administration, Economic justification.
Identifiers: *Public goods, *Voting, *Market mechanism, *Externalities.

Price theory deals with the use of a price mechanism in solving the production and allocation of resources among a population. However, society must deal with the production and distribution of the product of jointly owned scarce resources within a society. For this purpose the price mechanism alone has been found to be deficient. This situation is faced by water resources as a public good. The author discusses eight different mechanisms which may be used for the allocation of resources: (1) The economic market with a price system. (2) Voting procedures. (3) Bidding. (4) Bargaining. (5) Allocation by higher authority, fiat or dictatorship. (6) Allocation by force, fraud or deceit. (7) Allocation by custom, including gifts and inheritance. (8) Allocation by chance. The analysis concludes that the problems of large-system implementation and of external economies and diseconomies point away from a larger functioning of the price system. The conclusion of this article is of general interest to theoretical research in the public good nature of water projects. (Murphy-Rutgers)
W70-09664

MICRODATA, ECONOMIC RESEARCH, AND THE PRODUCTION OF ECONOMIC KNOWLEDGE,
National Bureau of Economic Research, New York.
F. Thomas Juster.
American Economic Review Vol LX, No 2, p 138-148, May 1970.

Descriptors: *Optimization, *Research and development, *Economics, *Data collections, Statistics, Pollution, Cost, Government, Measurement, Income, Forecasting, Resource allocation, Social aspects.
Identifiers: *Microdata, *Economic research, Research design, Private returns.

An attempt is made to show that the generation of precise sets of micro-observations growing out of the analytical requirements of a specific research problem is likely to provide a much more promising method of expanding economic knowledge than the application of more sophisticated, analytical and statistical techniques to existing data. The author demonstrates the gap which exists between private and social returns to alternative research strategies which prohibits normal market forces from bringing about the necessary reallocation of research resources. The budgetary implications of the research strategy outlined are shown to be formidible with the most significant returns from that strategy not appearing for many years. The large amount of economic research being conducted in the water resource area could be aided by the application of the principles described in the article. (Murphy-Rutgers)
W70-09665

WATER-SUPPLY STRINGENCIES-FEATURES, ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
Arthur M. Piper.
Boston College Industrial and Commercial Law Review, Vol 9, No 3, p 633-646, Spring 1968. 14 p, 34 ref.

Descriptors: *Water supply, *Water resources development, *Water law, Institutions, Governments, Legislation, Social aspects, Legal aspects, Economics, Water quality, Water yield, Water costs, Water shortage, Planning.
Identifiers: Water resources law.

It can generally be stated that present practices of water-supply management involve acquired habits some of which run counter to the realities of hydrology. These habits all too often take the form of policies and decisions which look towards selected effects rather than comprehensive objectives. Specifically, a resolution of foreseeable stringencies of supply must contend with illogical concepts for allocating available supplies among uses both present and prospective with circumscribed and, in many instances, inadequate institutional concepts, and with inflexible water law. It can thus be said that any success in resolving foreseeable stringencies at a still relatively early time--and thus precluding a later generation of more complex stringencies--may be measured in terms of breaks from traditional concepts and procedures. Solutions both bold in scale and novel in purpose are required. (Knapp-USGS)
W70-09852

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.
For primary bibliographic entry see Field 06A.
W70-09513

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-C - ALLOCATION PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09514

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-D - STAGE DEVELOPMENT PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME VI - RESEARCH ACCOMPLISHMENT AND COST SUMMARY.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09519

INPUT-OUTPUT ANALYSIS OF WATER USE FOR NEBRASKA INDUSTRIES,
Nebraska Univ., Lincoln. Water Resources Research Inst.
A. W. Epp, and Maurice Baker.
Available from NTIS as PB-193 798, $3.00 in paper copy, $0.65 in microfiche. Technical Research Project Completion Report, August 1970. 15 p, 5 ref.

Descriptors: *Costs, *Irrigation, *Benefits, Nebraska, Analysis, Water rates.
Identifiers: Water productivity, Industry location.

The input-output analysis indicated that water was of minor importance to industry in deciding where to locate. Site selection by industry is based upon more important factors than water costs. A doubling of water costs for five heavy water using industries would increase cost of products less than one percent. Water costs in the meat packing and dairy processing industries were of minor importance. Those plants which purchased water from municipal water systems generally realized a greater productivity from water than those who had their own wells. The net benefits from irrigation with limited quantities of water were greatest when 21,000 acres were irrigated with direct stream diversion. Other alternatives considered were 21,000 acres with storage, 10,500 acres direct diversion. The net benefits ranged from minus (-) $128,000 for the 10,500 acres with storage to $284,000 for the 21,000 acres with direct diversion. The cost-supply study included three areas representing direc diversion, on-stream storage and off-stream storage types of projects. Nearly 65 percent of the water in the on-stream storage system was delivered to the farm while the other two

systems delivered only 52 to 53 percent of the water diverted. The cost per acre-foot of water supplied was $15.54, $20.33, and $22.58 for the direct diversion, off-stream storage and on-stream storage respectively. The on-stream storage system was able to deliver 0.072 acre-feet per dollar cost while the other two delivered 0.055 and 0.060 acre-feet per dollar cost for the off-stream storage and direct diversion respectively.
W70-09525

SOME ANALYTICAL RESULTS ON TAX DEPRECIATION,
American Telephone and Telegraph Co., New York.
Peter B. Linhart.
Bell Journal of Economics and Management Science Science Vol 1, No 1, p 82-112 Spring 1970.

Descriptors: *Depreciation, *Public utilities, *Government, *Economic evaluation, Mathematical studies, Taxes, Capital, Model studies, Debt, Rate of interest, Planning, Forecasting, Rate of discount, Costs.
Identifiers: *Accelerated tax depreciation, *Utility regulation, Firm growth rate, Flowthrough, Normalization, Rate of return.

This paper is an attempt to shed some light on the debate concerning the conflict between regulatory bodies and those utilities that would like to use accelerated tax depreciation as a source of working capital through normalization. It provides an analytical framework within which the effects of various depreciation policies on utilities, their customers and the Federal Treasury can be examined with some precision and generality. The main emphasis is on regulated utilities and the author shows that following a switch from straight-line book and tax depreciation to accelerated tax depreciation, with flowthrough, very substantial rate increases will always be required after a fixed interval, regardless of the firm's growth rate. Since most water utilities are of the regulated type described in the paper, the author's conclusions should be of interest to the water utility manager. (Murphy-Rutgers)
W70-09662

6D. Water Demand

INDUSTRIAL USE AND COMMUNITY SUPPLIES OF WATER IN ALABAMA,
Auburn Univ., Ala. Water Resources Research Inst.
Donald R. Street, Robert R. Criss, Robert L. Burks, and James H. Baker.
Available from NTIS as PB-193 796, $3.00 in paper copy, $0.65 in microfiche. School of Business, Research Series I, January 1970. 111 p, 55 ref, 6 append. OWRR ProjectB-012-ALA (1).

Descriptors: *Water use, Industrial water, Water supply, Water allocation (Policy), Domestic use.
Identifiers: *Alabama, Alabama Water Improvement Commission.

This report identifies present and potential areas of conflict between water users in the State of Alabama. Even though at the present time there is an adequate supply of water for most industrial as well as community uses, the authors foresee major conflicts in the near future. They came to this conclusion after detailed study of water usage data collected from major industrial water users and from municipalities of over 100 persons in Alabama. Since Alabama has no comprehensive water resources usage law the authors urge the state legislature to evaluate water usage data and to formulate legislation which would lead to a more rational distribution and conservation of Alabama's water resources. (Holmes-Rutgers)
W70-09521

DEVELOPMENT OF INTERNATIONAL RIVER BASINS: REGULATION OF RIPARIAN COMPETITION,
For primary bibliographic entry see Field 06E.
W70-09776

6E. Water Law and Institutions

CITY OF NEWARK V DEP'T OF HEALTH (ADMINISTRATIVE DETERMINATION OF WATER POTABILITY).

109 N J Super 116, 262 A2d 718-725 (1970).

Descriptors: *New Jersey, *Standards, *Water quality control, *Administrative decisions, Regulation, Public health, Judicial decisions, Legal aspects, Legislation, Local governments, Political aspects, Public benefits, Public rights, Social aspects, State governments, Potable water, Water purification, Water quality, Water pollution, Turbidity, Reservoir storage, Water treatment, Water supply, Flocculation, Administrative agencies.

Defendant Department of Health ordered plaintiff city and nearby municipalities to build a water treatment facility which would elevate the purity of their mutual water supply to defendant's minimum standards. Plaintiff brought action for a declaratory judgement, contending that such standards exceeded the authority delegated to defendant by the legislature in that the legislature had conferred upon defendant authority to determine only standards of water potability. Plaintiff argued that such authority did not include the determination of requirements as to purity of color, degree of turbidity and the like. The court held that the statutory language of the legislature indicated a broad delegation of powers to defendant in the area of public health, including the specific authority to regulate the purity of potable water and to enforce such regulation by administrative order. Furthermore, when dealing with statutes that promote public health, courts traditionally apply a liberal construction regarding supervisory and regulatory powers. The only test is whether such acts are reasonably related to the ends sought. The court held that defendant's standards of purity easily met that test. (Clarke-Florida)
W70-09527

LAKE FRONT EAST 55TH ST CO V CITY OF CLEVELAND (SUBSEQUENT GRADUAL ACCRETIONS AS NOT AFFECTING BOUNDARIES DETERMINED UNDER TORRENS ACT).
36 NE2d 196-197 (Ohio Ct App 1961).

Descriptors: *Ohio, *Accretion (Legal aspects), *Boundaries (Property), *Shores, Real property, Land, Land forming, Judicial decisions, Remedies, Boundary disputes, Regulation, Standards, Movement, Fluctuation, Legal aspects, Cities, Local governments, Relative rights.
Identifiers: *Torrens Act.

Plaintiff corporation had previously initiated an action under the Torrens Act, seeking and receiving a decree in which the location, direction and approximate length of the shore line to his property was determined. In later years the shore line was advanced by gradual accretions. Plaintiff brought this action to acquire title to the accretive land, as well as to obtain a change of his boundaries. In a per curiam opinion, the court held that plaintiff's rights were limited to the lands within the boundary lines established by the Torrenization proceedings. The court stated that the established rule of law required that once boundaries had been determined under the Torrens Act, such boundary lines did not change and were not affected by subsequent events. (Finman-Florida)
W70-09547

DOWNES V CROSBY CHEMICALS, INC (PUBLIC RIGHT OF ACCESS UPON NON-NAVIGABLE CREEK).

234 So 2d 916-922 (Miss 1970).

Descriptors: *Mississippi, *Non-navigable waters, *Ownership of beds, *Public rights, Navigation, Streams, Riparian rights, Streambeds, Navigable waters, Banks, Judicial decisions, Beds under water, Relative rights, Access routes, Legal aspects, Boating, Usufructuary right, Legislation, Remedies, Bodies of water.

In an action to quiet title and enjoin a trespass, plaintiffs contended that defendants had no right to enter upon a creek, the bed of which was owned by plaintiffs. Defendants asserted that they, as members of the general public, had a right to enter the creek with boats. The court held that the general public has a right to enter upon public streams regardless of who owns the bed of such streams. However, a public stream is one which is navigable as defined by statute or one which is navigable in fact. No statute was here applicable and the evidence showed that the creek was a small stream with relatively little water and with numerous obstacles, drifts, and jams. The stream was not navigable in fact nor by statute and, as such, was not a public stream upon the general public had a right to enter. The decree permanently enjoining defendants from further trespass upon plaintiffs' creek was affirmed. (Snow-Fla)
W70-09553

BOSTON EDISON CO V GREAT LAKES DREDGE AND DOCK CO (DAMAGES FROM DREDGING OF NAVIGABLE RIVERS).
423 F2d 891-897 (1st Cir 1970).

Descriptors: *Dredging, *Navigable rivers, *United States, *Transmission lines, River beds, Powerline carriers, Channel improvement, Stream improvement, Rivers, Beds under water, Underground, Legal aspects, Remedies, Judicial decisions, Federal government, Projects, Communication, Electrical networks, Administrative agencies, Damages.

Plaintiff brought an action against the United States and its dredging contractor for damages to plaintiff's power cables under a navigable river. Plaintiff contended that defendants were negligent in conducting dredging operations. Plaintiff's cables had been installed under the river pursuant to a permit issued by the Secretary of the Army, who had been authorized by Congress to make regulations for the use of the navigable waters of the United States. The government contended that a provision of plaintiff's permit exculpated the government from liability for damages caused by operations of the government in improving navigation. Plaintiff argued that, in light of the enunciation of governmental policy in the waiver of sovereign immunity by the Federal Tort Claims Act, the insertion of such provision was beyond the power validly delegated to the Secretary. The court held that governmental immunity still existed as to discretionary acts and that the Secretary's decision to dredge was such a discretionary act. Thus, the disclaimer of liability by the Secretary did not contradict any governmental policy and was not in excess of his delegation to make regulations. The exculpatory provision being valid, the summary judgment dismissing plaintiff's claim against the government was affirmed. (Snow-Fla)
W70-09555

GARDEN CONSTRUCTION CO V UNITED STATES (ACTION FOR THE WRONGFUL TAKING OF PROPERTY WITHOUT COMPENSATION).
423 F2d 273-277 (Ct C1 1970).

Descriptors: *United States, *Drainage, *Easements, *Eminent domain, Pipes, Judicial decisions, Legal aspects, Cities, Federal government, Local governments, Streams, Diversion, Roads, Road construction, Surface drainage, Drainage practices,

inage systems, Drainage effects, Damages, ter management (Applied), Surface runoff, ins, Ditches.

fendant United States installed a drainage pipe its property which, pursuant to an approved n, discharged water into a county roadbed itting its land. Since the stream was eliminated m use, plaintiff, to provide drainage to the coun- pursuant to its obligations in the creation of an ustrial park, was required to grant the county an ement across other parts of its land and to lay eline to drain off water in the roadbed which d accumulated after being discharged from de- dant's property. Plaintiff contended that defen- nt's acts which caused the water to accumulate d which required plaintiff to grant an easement d lay pipelines, amounted to a taking of its pro- rty without compensation. The court held that ce there was no direct invasion of plaintiff's land drainage water, since defendant was duly per- tted to empty water into the roadbed, and since ch water was carried away by pipes and a ainage easement which was compelled by the unty and not defendant, it could not be con- ded that plaintiff's costs and damages resulted m a taking by defendant of plaintiff's property. arnett-Fla)
70-09561

ARISH OF JEFFERSON V UNIVERSAL LEETING CO (RIPARIAN RIGHT TO USE OF ANKS OF NAVIGABLE STREAM).
34 So 2d 88-93 (La Ct App 1970).

escriptors: *Louisiana, *Beds, *Banks, *Naviga- e rivers, Mississippi River, Regulation, Judicial ecisions, Legal aspects, Levees, Riparian land, iparian rights, Cities, Boats, Reasonable use, hores, Overflow, Public rights, Streams, Legisla- on, Administration, Usufructuary right, Zoning.
dentifiers: *Batture land.

laintiff parish passed an ordinance zoning certain atture land for single-family residence. Defendant eased land on the batture for the purpose of moor- g its barges. Plaintiff brought suit to enjoin the ommercial use of the batture in violation of its or- inance. The lower court dismissed the suit, hold- ng the ordinance to be unreasonable, arbitrary, nd discriminatory. The appellate court affirmed. he court stated that the use of the banks of avigable rivers is a public right. Everyone has a ree right to land and moor his vessels, although the anks belong to those who own the adjacent land. he court held that the batture in question was within the bank of the Mississippi River and that he riparian owner owned the batture subject to the ervitude of public use, i.e. that use which is in- cident to the nature and navigational character of he stream. The riparian owner could use the bat- ture in any reasonable manner, provided he did not seriously obstruct or impede the public use of the banks. The restriction of the batture to use as a sin- gle-family residence was an unconstitutional use of the zoning power in conflict with the laws of the state. (Barnett-Fla)
W70-09591

THERMAL STANDARDS IN THE UNITED STATES OF AMERICA,
Federal Water Pollution Control Administration, Duluth, Minn. National Water Quality Lab.
For primary bibliographic entry see Field 05G.
W70-09595

GILL V PORTER (PROPERTY LINES OF RIPARIAN LANDOWNERS ON OPPOSITE SIDES OF ABANDONED RIVERBED).

450 SW2d 306-308 (Ark 1970).

Descriptors: *Arkansas, *Avulsion, *Boundaries (Property), *Ownership of beds, Soil erosion, River beds, Navigable rivers, Non-navigable waters, Valleys, Topography, Cutoffs, Riverflow, Thalweg, Accretion (Legal aspects), Boundary disputes, Real property, Dredging, Banks, Judicial decisions, Land tenure, Riparian land, Riparian rights.

As a result of a cut-off dredged by the Army Corps of Engineers, the Arkansas River abandoned its original channel. A boundary dispute arose between the riparian landowners on opposite sides of the abandoned river channel. Plaintiff landowner contended that the boundary should be a line through the channel equidistant from the channel's banks. Defendant landowner contended that the boundary should have been fixed along the thalweg of the river at the moment it became non-navigable. The trial court accepted plaintiff's contention. On appeal, the Supreme Court of Arkansas stated that the state's title rests on navigability, and once the navigability ceases, the rights of the riparian owners attach to the beds. The court also cited with approval a previous United States Supreme Court decision wherein it was stated that when a river channel is changed by accretion, the boundary follows the course of the stream, but if the change is caused by avulsion, the boundary remains in the middle of the old channel. The court, in reversing the trial court, held that here the channel alteration was caused by avulsion, and once the river became non-navigable, the boundary line should have been fixed along the thalweg of the abandoned channel. (Price-Fla)
W70-09598

CITIZENS COMM FOR HUDSON VALLEY V VOLPE (AUTHORITY TO ISSUE PERMITS FOR CAUSEWAY CONSTRUCTION).
425 F2d 97-107 (2nd Cir 1970).

Descriptors: *Hudson River, *Permits, *Federal government, *Administrative decisions, Highway effects, Bridge construction, Remedies, Rivers and Harbors Act, Environmental effects, Highways, Landfill, Dredging, Conservation, Water law, Legal aspects, Dikes, Natural resources, Recreation, Aesthetics, Administrative agencies, Judicial decisions.
Identifiers: *Army Corps of Engineers, Causeways.

Plaintiff citizen groups brought actions to enjoin defendant Army Corps of Engineers from issuing a permit authorizing the state to conduct a dredge and fill operation for an expressway project and to revoke the state's existing permit. Plaintiffs contended that the proposed expressway would adversely affect the local environmental and scenic resources and that the Corps of Engineers had exceeded its authority in approving the project since it contained dikes and causeways, which, by federal statute, could not be constructed without the consent of Congress and the approval of the Secretary of Transportation. Defendant argued that plaintiffs had no standing and that the Corps of Engineers did not have to consider the necessity of further federal approval before acting. The court held that civic groups concerned with preservation of natural, scenic and historic resources had standing to seek review of the Corps' decision. The court further held that the Corps of Engineers could not ignore the prospect of future federal approval. The court affirmed the district court's order revoking the state's dredge permit and enjoining issuance of a new permit without first obtaining the consent of Congress and the approval of the Secretary of Transportation. (Liptak-Fla)
W70-09600

UNITED STATES V CERTAIN LAND IN THE COUNTY OF WORCESTER, STATE OF MARYLAND (VALUATION OF EASEMENTS IN CONDEMNATION SUIT).

311 F Supp 1039-1059 (D Md 1970).

Descriptors: *United States, *Maryland, *Easements, *Condemnation value, Condemnation, Compensation, Eminent domain, Economic impact, Beaches, Coasts, Shores, Harbors, Piers, Coastal structures, Docks, National parks, Federal government, Parks, Public lands, Land use, Judicial decisions, Legal aspects, High water mark, Low water mark.

The United States, plaintiff in condemnation suits brought for the establishment of a national park on an island off the coast of Maryland, sought to value certain reserved easements as nominal. Defendants, trustees of a liquidated landowners' corporation formed by the original individual owners of the island, argued that the easements were of more than nominal value. The easements included private use of the beach by members of the corporation, reservation of certain sites for a pier, a fuel dock, and a harbor site. The United States District Court of Maryland held that beach front property may be privately owned only to the high water mark, that the portion of the beach between high and low water marks is owned by the state for public use, and therefore that easements for the private use of the beach were only of nominal value. However, the remaining reserved commercial easements were held to be of more than nominal value. (Barker-Fla)
W70-09601

LAKE MICHIGAN BASIN STUDY: MICHIGAN SECTION.
League of Women Voters of Michigan, Detroit.
For primary bibliographic entry see Field 06B.
W70-09622

LAKE MICHIGAN BASIN STUDY-ILLINOIS SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09623

LAKE MICHIGAN BASIN STUDY: WISCONSIN SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09624

LAKE MICHIGAN BASIN STUDY: INDIANA SECTION-1.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09625

INTERESTS AND INTEREST GROUPS IN THE WATER POLICY PROCESS.
Colorado State Univ., Fort Collins.
Daniel M. Ogden.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 77-95.

Descriptors: *Political aspects, *Water resources, *Planning, *Resource development, Preservation, Institutions, Decision making, Regulation.
Identifiers: *Water resource policy, *Interest groups, Water resource politics, Pressure group system, Conflict resolution, Policy.

Politics is the critical ingredient in natural resources development decisions. Good engineering plans and economic analysis can determine whether a development is possible but politics decides whether it will be done. Water resource politics has been primarily interest group politics. Water issues are rarely settled on partisan political grounds. Water resources politics in the United States is based on two political foundations, the American political party and the pressure group system. The important characteristic of political parties is that they are based on consensus and compromise and as such are diffuse in direction

and goals. Three types of pressure groups, or political groups not seeking office, can be identified: service groups, political action groups, and goal groups. Pressure groups base their activity on the successful exploitation of access to political power holders. Three different thrusts in water politics are identified: a preservation thrust, a development thrust, and a regulationist thrust. A key to understanding politics in water resources decision-making is viewing politics as a process of conflict resolution. (See also W70-09628). (Davis-Chicago)
W70-09627

QUALITY OF THE URBAN ENVIRONMENT: THE FEDERAL ROLE,
Urban Inst., Washington, D.C.
Elizabeth H. Haskell.
The Urban Institute Publication 102-6, Washington, D.C., May 1970. 78 p, 4 graphs, 3 charts, 1 append.

Descriptors: *Federal government, *Planning, *Administration, *Institutions, Standards, Resource allocation, Regulation, Inter-agency cooperation, Coordination, Institutional constraints, Political aspects, Technology, Population.
Identifiers: *Urban environment, *Environmental quality, *Policy, Environmental problems, Resource policy, Goal, Urban ecology.

A number of recommendations are made regarding the role of the federal government in maintaining the quality of the urban environment. (1) National resource policy will benefit more people if its rural resource orientation is changed to an emphasis on scarce urban resources; air, water, and open space. (2) A comprehensive environmental quality policy stressing the following is needed: (a) study and publicize the interdependency of environmental systems, (b) reduce duplication of federal environmental quality activities and promote rational allocation of resources among the several programs, (c) assure that various environmental quality standards, planning and subsidy programs mesh, and (d) set a framework for identifying and managing the conflicts between environmental quality activities and environmental uses that substantially affect that quality, sponsored either by the public or private sectors. (3) Federal agency organization should reflect the following: (a) programs structure should match the structure of the problem, (b) programs involving similar goals can often profit from administrative proximity, (c) an organizational structure should promote administrative efficiency, and (d) organizational changes should take account of political realities. (4) Regional management of the environment is necessary to effectively deal with environmental problems. (5) Careful attention needs to be paid to the development of clear policy goals. (6) A prevention strategy rather than a reaction strategy is necessary. (7) A review of new technology would provide new insights into future problems. (8) A rational population policy has become a necessity and (9) An understanding of urban ecology must be developed. (Davis-Chicago)
W70-09635

ARNOLD'S INN, INC V MORGAN (PRESCRIPTIVE RIGHT TO FORESHORE BECAUSE OF LANDFILL).

310 NYS2d 541-550 (Sup Ct 1970).

Descriptors: *New York, *Landfill, *Ownership of beds, *Prescriptive rights, Shores, Marinas, Intertidal areas, Riparian rights, Local governments, Easements, Judicial decisions, Public lands, Public rights, Land tenure, Water law, Adjudication procedure, Relative rights, Remedies, Navigation, Fishing, Swimming, Access routes, High water mark, Low water mark.
Identifiers: *View, Injunction (Mandatory).

Plaintiff restaurant owner sought an injunction to compel defendant marina operator to remove landfill which alledgedly cut off the restaurant patrons' view across the bay and thereby interfered with plaintiff's riparian rights. Plaintiff town filed action against the marina operator claiming the landfill trespassed upon the publicly owned shore. After reviewing the nature of the jus publicum, the right of the public to navigate the waters over the foreshore, and the jus privatum, the right of the foreshore's owner, the court dismissed plaintiff restaurant owner's claim, finding that plaintiff's riparian rights included access to the water for navigation, fishing, and bathing, but not an easement of view. As to the plaintiff town, defendant contended that he had acquired title to the public land by prescription. However, the town argued that there could be no adverse possession against a governmental authority. The court held that prescriptive rights may arise against a town where the land is alienable as was the case here; however, the evidence refuted defendant's possession of the land for the requisite prescriptive period. The court therefore granted the relief sought by the town and ordered defendant to remove the landfill. (Liptak-Florida)
W70-09638

WHY A NATIONAL WATER COMMISSION,
National Water Commission, Washington, D.C.
Theodore M. Schad.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 2, Fall-Winter 1969-70, p 26-31. 5 photo.

Descriptors: *Water policy, *Water resources development, *Water management, *Planning, *Environmental effects, Economics, Socail aspects, Aesthetics, Administration, Legislation, History, Water conservation, Water demands, Water utilization, Water quality, Institutions.
Identifiers: *National Water Commission, Policy decisions, National water program, Alternatives.

Changes in national water policy are needed to assure that new demands for water will be met and to place limits on irreparable damage to our environment. The Nationa Water Commission was established to review present and anticipated rational water resource problems and alternative solutions. Advantages and disadvantages of solutions are studied with consideration of the economic and social consequences of water resources development on regional growth, on institutional arrangements, and on aesthetic values. The National Water Commission has outlined four general study areas as background for its deliberations and policy recommendations: (1) delineation of future problems and needs, (2) appraisal of existing water activities, (3) consideration of ways to improve existing institutions, and (4) analysis of objectives for the national water program. The article includes a resume of the history of the National Water Commission and its members, and a discussion of the authorizing legislation. Descriptions of the kinds of reports and studies presently being undertaken are given. It is hoped that the Commission's report and recommendations will be helpful in implementation of water policy decisions that reflect national objectives and that will not merely provide a program for economic development of the Nation's water supplies but will, also provide a program that protects the quality of the environment. (Marriott-Chicago)
W70-09641

THE CONSTRUCTION OF TRUST: AN EXPERIMENT IN EXPANDING DEMOCRATIC PROCESSES IN WATER RESOURCES PLANNING,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Spencer W. Havlick.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 2, Fall-Winter 1969-70, p 13-19. 4 photo.

Descriptors: *Water management, *River-basin development, *Water resources development, *Planning, Community development, Institutions, Decision making, Methodology, Attitudes, Evaluation.
Identifiers: Susquehanna Experiment, Susquehanna River Basin, Atlantic Coast.

An experiment by the Corps of Engineers design to improve trust in agency activities through increased communication and citizen participation a multi-state comprehensive river basin planning study. Two major objectives of the Susquehanna experiment were: (1) to formulate alternative development and management strategies and present these to the public for preliminary consideration and (2) to incorporate preferences, additional suggestions, of the 'recipient' citizenry's plans to accomodate the present and projected water-related needs. The research design and methodology sought first to identify the 'water resource influentials' in each county and community studied. These people were then involved in information workshops and public forums. The format of these workshops and forums is discussed in detail. Preliminary findings are given. The workshops were effective in directly influencing the planning staff, especially on localized adjustments. There were problems in differentiating between technical decisions and value judgments regarding the desirability of various alternative solutions. In conclusion, the engineering profession needs, in general, to create a greater sensitivity to citizen expectations in water resource planning. (Marriott-Chicago)
W70-09642

WATER PLANNING: MAKING A MESH OF THINGS,
Water Resources Council, Washington, D.C.
Henry P. Caulfield, Jr.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, p 27-29, Summer 1969.

Descriptors: *Water Resources Planning Act, *Water management, *River basin development, Water resources, Assessments, Evaluation, Water conservation, Water utilization.
Identifiers: *Water Resources Council, Coordination.

The structure, functions, and activities of the Water Resources Council, established under the Water Resources Planning Act, are described. Principle members of the Council are the Secretaries of the Interior; Agriculture; the Army; Health, Education, and Welfare; Transportation; and the Chairman of the Federal Power Commission. Associate members are the Secretary of Commerce and the Secretary of Housing and Urban Development. Other Agency heads are asked to participate when topics touch on their responsibilities. Council functions are: (1) to maintain a continuing study and make a periodic assessment of the adequacy of the Nations' water supply; (2) to establish principles, standards and procedures for Federal participation in the preparation of comprehensive regional or river basin plans--and for the formulation and evaluation of Federal water and related land resources projects; (3) to review comprehensive river basin plans prepared by river basin commissions or interagency committees and transmit them together with the Council's recommendations, to the President for transmittal to Congress. Actions initiated as a result of these functions are given in some detail. (Marriott-Chicago)
W70-09643

WATER POLLUTION: GREATER CALUMET AREA-INDIANA-ILLINOIS.
League of Women Voters of Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09647

SKOWYSZ V CITY OF VENTNOR (RIGHT OF CITY TO SELL PUBLIC BEACH).

110 N J Super 340, 265 A2d 554-561 (1969).

Descriptors: *New Jersey, *Beaches, *Accretion (Legal aspects), *Public lands, Cities, Legislation, Governments, Planning, Public benefits, Public

ghts, Legal aspects, Water law, Coasts, Sands, hores, Recreation facilities, Bulkhead line, Jetties, ulkheads, reclamation, Coastal structures, Judi- al decisions, Local governments.

laintiff taxpayers brought suit against defendant ity to set aside an ordinance authorizing the sale of ertain beach front land. Plaintiff also sought to en- in the sale of the land. Plaintiffs argued that the nd in question was held by the city for public use s a recreation area and, as such, could not under, ew Jersey statute, be sold. Defendant argued that proposed plan for the construction of jetties ould through reclamation create new land below he existing bulkhead and that the existing beach roperty would no longer be needed for public use. his, it was contended, exempted the sale from the tatutory prohibition. The Superior Court of New ersey, reviewing a trial court decision for defen- ant, held that the proposed creation of new beach id not constitute reclamation, but was accretion, hus falling outside of the statutory authority for ale by a municipality of land no longer held for the ublic. The court ruled that reclamation contem- lates the construction of a new bulkhead and a illing-in of land, whereas accretion is merely an ad- ition to existing shore line. (Barker-Florida) W70-09650

UNITED STATES V LOUISIANA (TEXAS BOUNDARY CASE).
3 Am J Int'l L 837-838 (1969) 2 p, 8 ref.

Descriptors: *Texas, *Boundary disputes, *Owner- hip of beds, *Submerged Lands Act, Boundaries Property), Federal government, Federal jurisdic- ion, International law, Judicial decisions, Legal spects, Legislation, Relative rights, State govern- ments, State jurisdiction, Erosion, Accretion Legal aspects), Federal-state water rights con- licts, Gulf of Mexico.
Identifiers: *Seabeds.

The Submerged Lands Act of 1953 granted to the State of Texas lands under the Gulf of Mexico ex- tended outward from its coastline for 9 miles. The dispute arose as to whether Texas' present coast- line configuration should be used to determine the 9 mile boundary limitation or whether the coastline that existed in 1845 when Texas was admitted to the Union should be used. The Supreme Court held that the term 'coastline' as used in the Act must mean the modern ambulatory coastline defined in the 1958 Convention on the Territorial Sea and the Contiguous Zone. The court stated that any in- equitable results derived from a consistent applica- tion of the scheme which Congress fashioned. Con- sequently, Texas would have to look to Congress and not the courts for relief from such results. (Clarke-Florida) W70-09651

SHORT COURSE ON LEGAL ASPECTS AND RESPONSIBILITIES FOR ALLOCATION OF WATER RESOURCES (FEDERAL LAW OF WATER RESOURCES).

Idaho Water Resources Institute, Division of Con- tinuing Education, Univ of Idaho (June 1969).

Descriptors: *Idaho, *Federal government, *Ad- ministrative agencies, *Water resources develop- ment, Federal Power Act, Federal-state water rights conflicts, Administration, Regulation, Federal jurisdiction, State jurisdiction, Water Resources Research Act, Federal Reclamation Law, Hydroelectric project licensing, Project pur- poses, Legislation, Judicial decisions, United States, Recreation, Fishing, Wildlife conservation, Water pollution control, Water resources, Manage- ment, Water conservation.
Identifiers: Constitutions.

The primary concern of this series of individual papers and speeches is to examine in detail the con- stitutional, statutory, decisional and administrative aspects of both Idaho surface water law and federal water resources law. Considerations of federal law include: (1) federal water rights on public domain; (2) constitutional powers with respect to water rights and regulation; (3) relative state and federal jurisdictions over fish and wildlife; and (4) Federal Power Commission responsibilities under the Federal Water Power Act. In the area of water resources development and management, the func- tions, responsibilities, organization and activities of the following federal bodies are outlined: (1) U.S. Farmer's Home Administration; (2) U.S. Soil Con- servation Service; (3) U.S. Agricultural Research Service; (4) U.S. Economic Research Service; (5) U.S. Bureau of Outdoor Recreation; (6) Federal Water Pollution Control Administration; (7) Federal Power Commission; (8) U.S. Army Corps of Engineers; (9) U.S. Forest Service; (10) U.S. Geological Survey; (11) U.S. Bureau of Land Management; (12) U.S. Bureau of Reclamation; (13) U.S. Office of Saline Water; (14) U.S. En- vironment Science Services Administration; (15) U.S. Fish and Wildlife Service; and (16) U.S. Of- fice of Water Resources Research. (Marsee-Florida) W70-09654

THE EXECUTIVE FUNCTION IN WATER RESOURCES PLANNING,
Delaware River Basin Advisory Committee, Trenton, N.J.
Walter M. Phillips.
In: Regional Development and the Wabash Basin p 157-165, University of Illinois Press, Urbana, 1964.

Descriptors: *Planning, *Water management, Water resources development, River basins, Delaware, Water resources, Governments, Local governments, State governments, Federal govern- ments.
Identifiers: *Executive function, Political jurisdic- tion.

The thesis of this paper is that the executive role is essential in water resource planning, management, and development. The fact of multiple political ju- risdictions exercising authorities over interstate rivers, coupled with normal complexities of three- level government-local, state, and federal-and further coupled with the diffusion of agencies deal- ing with water at both the state and the federal levels, has frustrated the executive process required for coherent dealing with water in many such river basins. To establish this point systemati- cally would require an exhaustive treatise. This paper illustrates the water problems of the Delaware and describes the new governmental machinery created by the inter-state federal com- pact for the exercise of certain executive, quasi-ju- dicial, and quasi-legislative functions relating to the waters of the Delaware. (See also W70-09656) (Loeb-Rutgers) W70-09659

TOWN OF HEMPSTEAD V OCEANSIDE SMALL CRAFT MARINA, INC (ACTION BY TOWN TO RECOVER FAIR RENTAL VALUE OF ITS UNDERWATER LANDS USED BY DE- FENDANT MARINA).

311 NYS2d 668-674 (Sup Ct 1970).

Descriptors: *New York, *Cities, *Marinas, *Beds under water, Rent, Recreation facilities, Boats, Docks, Inland waterways, Navigable waters, Leases, Ownership of beds, Riparian rights, Legal aspects, Judicial decisions, Access routes, Riparian land, Recreation, Structures, Piers, Tidal effects, Silting, Permits.

Plaintiff town sought to charge rent for defendant marina's use of underwater land belonging to the town. Because the marina owned the riparian land adjacent to the town's beds, it claimed the right to use the beds without rent as a matter of riparian right. The court held that the town could not charge rent for its underwater lands which were used primarily for access from defendant's docks to its upland riparian property. However, the court found that the operation of the marina in charging rent for the use of its docks and other facilities was a distinct activity. The town was therefore entitled to charge rent for that portion of its beds which were being used to support a commercial docking activity. Emphasizing that the case in no way imp- inged upon the right of the town to require a permit for the use of its property, the court held the town entitled to fair rental. (Caldwell-Florida) W70-09670

KNOX COUNTY V MONCIER (INVERSE CON- DEMNATION SUIT BROUGHT BECAUSE OF FLOODING CAUSED BY HIGHWAY CON- STRUCTION).
455 SW2d 153-158 (Tenn 1970).

Descriptors: *Tennessee, *Condemnation, *Flood- ing, *Highway effects, Damages, Road construc- tion, Drainage, Highways, Flood damage, Floods, Land use, Legal aspects, Remedies, Drainage pat- terns, Payment, Judicial decisions, Legislation, Ad- ministrative agencies, Flooding, Land tenure.
Identifiers: *Inverse condemnation.

After the initiation of construction of a nearby highway, plaintiff's property was flooded. The State Highway Department subsequently made an effort to improve the drainage of plaintiff's land, but the property was later flooded again. Plaintiff filed suit seeking inverse condemnation of the property, claiming that the highway's alteration of his land's drainage patterns had made it unusable. Defendant county argued that the statutory one-year limita- tion on such suits began to run on the date of the original flooding and that plaintiff's suit was there- fore barred. The court rejected this argument, holding that in view of the work done by the Highway Department after the first flood, the plain- tiff could reasonably have thought the injury only temporary. The statute was triggered only when plaintiff knew or should have known that the injury to his property was permanent. The court held that this knowledge was not chargeable to plaintiff until after the second flood, and that his suit was not barred by the statute of limitations. (Caldwell-Florida) W70-09676

STATE V JOHNSON (STATUTE RESTRICTING USE OF PLAINTIFFS' MARSHLAND HELD UN- CONSTITUTIONAL).

265 A2d 711-717 (Me 1970).

Descriptors: *Maine, *Legislation, *Wetlands, *Land development, Marshes, Administrative agencies, Remedies, Land use, Landfills, Conserva- tion, Legal aspects, Coastal marshes, Shore protec- tion, Judicial decisions, Relative rights, Zoning, Reasonable use, Natural resources, Land classifica- tion, Property values, Land tenure.
Identifiers: *Constitutionality, *Police power.

A Maine conservation statute severely restricted the use which could be made of coastal wetlands. When plaintiffs' application to fill their marshlands for commercial development was denied, they sought to have the statute declared unconstitu- tional. The court found that the procedures pro- vided by the statute were not deficient, but that the act as applied to defendants was an unreasonable exercise of the police power. The court found that the land was valueless without the requested fill. It was reasoned that to leave plaintiffs with commer- cially valueless land in order to uphold the restric- tions imposed by the statute would be to charge plaintiffs with more than their just share of the cost of the statewide conservation program. The deprivation of reasonable use of plaintiffs' land was held unconstitutional. (Caldwell-Florida) W70-09700

PUBLIC ACCESS TO BEACHES,
Steve A. McKeon.

Stanford Law Review, Vol. 22, p 564-586 (1970). 22 p, 135 ref.

Descriptors: *Beaches, *Public rights, *Access routes, *Recreation demand, Land tenure, Beneficial use, Recreation, Public benefits, Seashores, Intertidal areas, Littoral, Easements, Land use, Administrative agencies, Regulation, Land development, Legal aspects, Judicial decisions, Legislation, Prescriptive rights, Right-of-way, Social aspects, Relative rights.

Private ownership of beaches often conflicts with increasing public need for beach recreation areas. Intertidal portions of beaches are universally publicly owned, but the dry-sand areas are the desirable areas for recreation. Public rights can be established in privately owned beach property by the creation of beach parks through condemnation or through creation of easements into the dry sand beach area. Subdivision exactions offer one method of easement creation; beachfront developers can be required to dedicate a portion of the property to public use in the same manner as such developers are required to dedicate property for use as streets. In litigation to confirm rights based on public use, courts have generally favored recognition of the public right of access. Theories of implied dedication through the owner's inaction in the face of continued public usage have been employed. California courts have required only 5 years of public use to create an implied dedication. The common-law doctrine of customary rights has also been used in this regard. (Caldwell-Florida)
W70-09775

DEVELOPMENT OF INTERNATIONAL RIVER BASINS: REGULATION OF RIPARIAN COMPETITION,
Nitza Shapiro-Libai.
Indiana Law Journal, Vol. 45, p 20-55 (1969). 35 p, 127 ref.

Descriptors: *River basin development, *International law, *International waters, *Water resources development, River basins, International commissions, Governments, Riparian land, Treaties, Water allocation (Policy), Natural resources, Legal aspects, Relative rights, Water rights, Water utilization, Competing uses, Consumptive use, International Joint Commission, Equitable apportionment, Water demand, Priorities, Adjudication procedure, Political aspects.

Because of disagreements between nations, many river basins which straddle international boundaries remain underdeveloped, even though the technological tools for development are available. The author contends that the function of international law in this area should be to transfer to the legal plane the level of achievement attained on the technical plane. Outmoded oncepts of territorial supremacy and integrity hamper international river basin development. The territory supremacy principle gives each nation exclusive jurisdiction over the segment of the river within its boundaries. The territorial integrity principle is the opposite side of the coin, each nation being prevented under international law from altering the natural conditions within its own territory to the injury of a neighboring nation. The author argues that the best approach is to consider the river basin as a unit, using the principle of equitable apportionment to allocate water among nations sharing the river basin. Competing uses could thus be reconciled. International commissions could act as adjudicating agencies, and the peaceful development of water resources would be aided. (Caldwell-Florida)
W70-09776

THE FEDERAL-STATE OFFSHORE OIL DISPUTE,
James W. Corbitt, Jr.
William and Mary Law Review, Vol. 11, p 755-770 (1970). 15 p, 122 ref.

Descriptors: *Oil, *Federal jurisdiction, *State jurisdiction, *Ownership of beds, Continental shelf, Exploitation, Oil industry, Legal aspects, Judicial decisions, Submerged Lands Act, Coasts, Permits, Law of the sea, Legislation, Political aspects, Resource development, Resource allocation, Income, Leases, Boundaries (Property), Beds under water.

The ownership of offshore ocean beds has been historically a source of dispute between federal and state governments. Supreme Court cases awarding all ownership rights to the federal government were overruled by Congress when the Submerged Lands Act was passed. This act vested ownership of the beds, to a distance of at least three miles, in the coastal states. However, this Act has not resolved the difficulty as no feasible method of drawing a line between state and federal ownership has been devised. The author contends that no such 'absolute' solution is possible. The solution suggested by the author is one of wealth division, whereby the revenues derived from the exploitation of the offshore beds would be divided between the state and the federal governments. The underlying cause of the ownership dispute is the desire of each level of government to retain for itself the revenues from the seabed, and an equitable division of these revenues would accomplish a feasible solution. (Caldwell-Florida)
W70-09777

THE SOURCE AND SCOPE OF PUBLIC AND PRIVATE RIGHTS IN NAVIGABLE WATERS,
Leighton L. Leighty.
Land and Water Law Review, Vol. 5, p 391-440 (1970). 50 p, 224 ref.

Descriptors: *Navigable waters, *Public rights, *Federal jurisdiction, *Water rights, Non-navigable waters, Recreation, Riparian rights, Prior appropriation, Tidal waters, Ownership of beds, Legal aspects, Judicial decisions, Navigable rivers, Transportation, Treaties, Admiralty, Recreation, Inland waterways, Land tenure, Federal government, State jurisdiction, Regulation, Usufructuary right, Federal-state water rights conflicts.
Identifiers: *Constitutions.

The federal test of navigability is whether the body of water in question is in fact navigable or suitable for reasonable commercial use. Federal jurisdiction prevails over state control if the body of water is considered navigable, and this can make considerable difference in allocation of public and private rights. Federal controls over navigable waters have been exercised in areas of legitimate national concern. The federal test for navigability is mandatory only where ownership of beds of navigable waters is determinative. State owned beds may be disposed of under state law. Rights tg surface use, as opposed to bed ownership, is generally determined by state law. The author contends that the navigability test of determining private and public rights may well have outlived its usefulness. The general welfare, war powers, and commerce clause provisions of the Constitution give Congress an adequate base for jurisdiction over waters important enough to warrant national control. Determination of rights as to other waters should be left to state law. (Caldwell-Florida)
W70-09778

THE TRANSFER OF WATER RIGHTS FOR USE IN THE OIL INDUSTRY,
Paul S. Galeotos.
Land and Water Law Review, Vol. 5, p 441-448 (1970). 8 p, 32 ref.

Descriptors: *Water rights, *Industrial water, *Water utilization, *Oil industry, Riparian rights, Prior appropriation, Competing uses, Beneficial use, Leases, Land tenure, Water allocation (Policy), Economics, Priorities, Water contracts, Legal aspects, Natural flow doctrine, Diversion, Reasonable use, Water demand, Judicial decisions, Riparian land, Remedies, Consumptive use.

The author of this comment contends that wa rights must be made freely transferable in orde stimulate industrial growth. Otherwise new ind tries will be unable to obtain needed water: states following the prior appropriation doctri unappropriated water may be acquired by comm ing with appropriation statutes. Generally, a le may appropriate water rights. In any case, the propriation must be for a beneficial purp Where waters are already appropriated, realld tion problems arise. Resource developers often purchase water rights from a prior approp tor and change its use--subject only to state law to the rights of superior appropriators. Statutes duly restricting change of use hamper indust development. In riparian-rights states which fol the natural flow doctrine, any substan withdrawal from a stream is enjoinable downstream owners. The reasonable use doct of riparian law is more flexible. In view of incre ing industrial demands, both the appropriation the riparian rights doctrines need to be liberali to provide increased flexibility in provid adequate water supplies to all. (Caldwell-Florida)
W70-09779

VALIDITY AND CONSTRUCTION OF ANT WATER POLLUTION STATUTES OR O DINANCES.
Annot, 32 ALR3d 215-316 (1970). 102 p.

Descriptors: *Pollution abatement, *Water po tion, *Legislation, *Judicial decisions, Water po tion control, Water resources development, Le aspects, Governments, Administration, Water l Non-structural alternatives, Pollutants, Wa quality control, Water pollution treatment, Pub health, Standards, Riparian rights, Water allocat (Policy), Administrative decisions.

This annotation collects the cases in which courts have construed or passed upon the valid of statutes or ordinances designed to control prohibit the pollution of public waters. The anno tion also includes administrative regulations or ders that are general anti-pollution measures. T subject of water pollution is within the pol power of the state to protect the public heal Anti-water pollution statutes are attacked on va ous grounds: (1) unlawful taking or similar reasonableness; (2) local, special or private legis tion; (3) lack of authority; (4) unlawful delegati of authority, power or jurisdiction; (5) ille promulgation; and (6) arbitrary classifications. A ministrative regulations and ordinances regardi water pollution have been more prone to invalid tion than have statutes. In constructing anti-wa pollution measures, certain elements of specif violation have been examined by the courts: (1) t polluter, (2) the intent, (3) the pollutant, (4) t causation, (5) the pollution, and (6) the wate Some courts have held that alleged prescripti rights, alleged reasonable or necessary uses, and leged financial burdens do not constitute defens to violation of anti-water pollution measur (Powell-Florida)
W70-09780

LIABILITY OF UNITED STATES UNDE FEDERAL TORT CLAIMS ACT FOR DAMAG FROM FLOODING.
Annot, 4 ALR Fed 723-745 (1970). 23 p.

Descriptors: *Flooding, *Federal governmen *Remedies, *Legislation, Flood damage, Floo Flood protection, Legal aspects, Flood contro United States, Judicial decisions, Water polic Flood forecasting, Adjudication procedure, Wat rights, Projects, Federal project policy, Navigatio Irrigation, Wildlife conservation, Drainage pr grams.
Identifiers: *Governmental tort immunity.

In this annotation cases are collected which discu the liability of the United States under the Feder Tort Claims Act for property damage resultin from floods or flooding. The cases annotate represent both claims allowed and barred and a

cataloged under: (1) flood control; (2) irrigation, reclamation, and conservation; (3) navigation projects; (4) flood or weather forecasting; (5) wildlife preservation and control; and (6) maintenance of drainage facilities. A claim against the government will not lie where it is determined that it arose out of certain express exclusionary clauses in the Tort Claims Act, namely, a claim arising out of a discretionary function or duty, or a claim arising out of misrepresentation. The discretionary exclusion has precluded recovery: for flood damage claims based on government flood control project activities; irrigation, reclamation and conservation project activities; and various other government programs and projects connected with waterways. The misrepresentation exception has barred flood damage claims under complaints alleging inaccurate or misleading flood or weather forecasting. A statutory immunity for flood damage is also provided in the Federal Flood Control legislation. (Powell-Florida)
W70-09781

TITLE TO SUBMERGED LAND IN FLORIDA,
Richard Sollner.
Florida State University Law Review, Vol. 1, p 1-15 (1970). 16 p.

Descriptors: *Riparian rights, *Florida, *Ownership of beds, *Boundaries (Property), Legal aspects, Tidal waters, Seashores, Navigable waters, High water mark, Beds, Beds under water, Land tenure, Foreign countries, Governments, Judicial decisions, Water law, Navigable rivers, Civil law, Public rights, Treaties, Prior appropriation, History.
Identifiers: Land grants.

In this law review article Spanish law applicable to Florida from 1783-1821 is surveyed. Spanish ordinances have been interpreted to hold that navigable waters and the land thereunder were held by the Crown for public common use, and that grants of tidal waters would be inconsistent with the King's own ordinances. However, there is justification for the conclusion that certain administrative officials were delegated the power to grant private ownership in water bottoms in connection with land grants. Under the Treaty of 1819, in which Florida was ceded to the United States, the United States agreed to confirm and ratify all grants made by the King or his lawful authorities. The treaty of cession transferred only such rights as Spain owned and could convey. The United States would not receive title to the waters and lands under the waters if Spain had validly granted them to others. American interpretation of Spanish law and land grants is reviewed. The Florida Supreme Court has indicated that, in order for a Spanish grant to convey title to submerged land, it must clearly and specifically indicate such intention and be granted for a public purpose or for the advantage of the public. (Powell-Florida)
W70-09782

MAGNOLIA APARTMENTS, INC V HANES (CLAIM OF DAMAGE CAUSED BY INCREASED FLOW FROM UPHILL PROPERTY).

174 SE2d 828-832 (NC Ct App 1970).

Descriptors: *North Carolina, *Diversion, *Saturated flow, *Seepage, Flood damage, Alteration of flow, Drainage, Drainage systems, Ditches, Drainage engineering, Damages, Pipes, Storm drains, Surface runoff, Drainage water, Subsurface flow, Natural flow, Obstruction to flow, Railroads, Legal aspects, Pondage, Flow nets, Groundwater movement.

Defendant's land lay uphill from plaintiff's property and was separated from it by a railroad. Plaintiff claimed that a landfill on defendant's property had caused excessive seepage of groundwater onto plaintiff's property, saturating the soil and causing damage. The court held that while defendant could not divert water from its natural course so as to damage another's property, he had the right to increase the flow from his property onto plaintiff's. The evidence was held insufficient to show diversion or anything more than merely increased flow. The real cause of the soil saturation was found to be seepage from an accumulation of water against the railroad embankment on defendant's side. This accumulation was itself caused by broken and stopped-up drainage pipes under plaintiff's property. These pipes normally ran from defendant's land under plaintiff's land to storm drains farther downhill. In absence of any showing that defendant's fill operations had caused the pipes to fail, the action was dismissed. (Caldwell-Florida)
W70-09783

ENVIRONMENTAL QUALITY AND THE ILLINOIS LAWYER,
For primary bibliographic entry see Field 05G.
W70-09784

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
For primary bibliographic entry see Field 06F.
W70-09785

OFFSHORE MINERAL RESOURCES: A CHALLENGE AND AN OPPORTUNITY.
President's Panel on Oil Spills, Offshore Mineral Resources: A challenge and an Opportunity (1969). 17 p.

Descriptors: *Resource development, *Resource allocation, *Mineralogy, *Mineral industry, Federal government, Regulation, Water resources development, Shores, Coasts, Drilling, Administrative agencies, Resources, Conservation, Economics, Research and development, State governments, Local governments, Exploitation, Oil fields, Natural gas, Legal aspects.

The President's Panel on Oil Spills examined four areas: (1) mineral resources and multiple use, (2) pollution and safety, (3) evaluation of offshore resources, and (4) central planning and local interest. The Panel recommended that: (1) a Resource Advisory Board be established to advise on all matters pertaining to the development of resources; (2) prompt efforts be made to incorporate the advice and policies of state and local governments into the plans for development of the federal offshore mineral resources; (3) well-publicized public hearings be held in the areas where offshore resource developments are contemplated; and (4) data necessary for resource evaluation held by private companies, state and local governments and any other parties to exploration and development of offshore mineral resources be made available to those who must make decisions about their exploitation. The Panel also suggested that a class of escrow resources be recognized as a matter of policy. These resources would be placed in escrow for fixed periods of time instead of being extracted at present. (Powell-Florida)
W70-09788

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
H R Rep No 91-765, 91st Cong, 1st Sess (1969).

Descriptors: *United States, *Legislation, *Environment, *Ecology, Resource development, Legal aspects, Political aspects, Environmental effects, Federal government, Administrative agencies, Administration, Public health, Public benefits, Non-structural alternatives, Natural resources, Conservation, Land use, Supervisory control (Power), Planning, Water policy.

The purposes of the National Environmental Policy Act are: (1) to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; (2) to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; (3) to enrich the understanding of the ecological systems and natural resources important to the nation; and (4) to establish a Council on Environmental Quality. A declaration of national environmental policy is presented. The organization, duties and functions of the Council on Environmental Quality are enumerated. A statement of the House managers at the Senate House conference is set forth. (Powell-Florida)
W70-09789

ACT NO 769 (DISPOSAL FROM WATERCRAFT OF LITTER AND UNTREATED SEWAGE PROHIBITED).
Acts of Alabama, Act No 769 (1969).

Descriptors: *Alabama, *Sewage disposal, *Sewage, *Boats, Sewage treatment, Legislation, Legal aspects, Environmental sanitation, Water resources development, Regulation, Pollution abatement, Water pollution control, Waste disposal, Waste storage, Waste treatment, Marinas, Navigable waters, Permits, Regulation, Administrative agencies, Ships.
Identifiers: *Toilets.

The discharge of litter, untreated sewage from marine toilets, and other materials from a watercraft into Alabama waters is prohibited. The treatment of sewage discharged by marine toilets is required. The State Board of Health is authorized to adopt rules and regulations for the discharge of sewage and litter from watercraft, including permit requirements for manufacturers of marine toilets and devices. Marinas are required to furnish litter or trash receptacles for use by watercraft occupants. (Powell-Florida)
W70-09790

ACT NO 773 (TRANSFER OF PUBLIC WATER SYSTEMS: PROCEDURES).

Acts of Alabama, Act No 773 (1969).

Descriptors: *Alabama, *Water districts, *Water works, *Municipal water, Utilities, Regulation, Legislation, Legal aspects, Water supply, Administration.

Every public corporation which is organized in Alabama pursuant to authorization by a municipality and which owns a water system, and every municipality in Alabama in which any part of such water system is situated, is authorized to transfer and convey such systems to any other public corporation. The governing body of each transferor municipality and each transferor public corporation must authorize the conveyance of the water system through appropriate resolutions. The procedure for transfer of a water system accompanied by a lien is set forth. The form for publishing notice of a water system transfer is also prescribed. (Powell-Florida)
W70-09791

ACT NO 472 (STATE DOCKS DEPARTMENT AUTHORIZED TO CONSTRUCT AND MAINTAIN INTERNAL IMPROVEMENT FACILITIES; VARIOUS POWERS AND PURPOSES).
Acts of Alabama, Act No 472 (1969).

Descriptors: *Alabama, *Administrative agencies, *Docks, *Supervisory control (Power), Water resources development, Facilities, Engineering structures, Legis.ation, Legal aspects, State governments, Multiple-purpose projects, Right-of-way, Condemnation, Construction, Project purposes, Watercourses (Legal), Water conservation, Water utilization, Maintenance, Permits, Navigable waters, Streams.

This Alabama legislation authorizes the State Docks Department to promote and aid the commercial flow of agricultural products and the use of the waterways of the state. The Department is also

authorized to engage in works of internal improvement by promoting, developing, constructing, maintaining and operating within the state or along navigable streams and waterways all manner of facilities consistent with the 1969 Docks Amendment. The Department has the power to acquire rights-of-way and property necessary for the construction of facilities by gift, lease, purchase, negotiation, or condemnation. The Department may revoke any license granted by the state and may permit upland owners to occupy any part of the space between the high water mark and the low water mark of any navigable waterway or along the banks of any river, stream or waterway. (Powell-Florida)
W70-09792

AN ACT TO AMEND THE ALABAMA WATER MANAGEMENT ACT.
Acts of Alabama, Act No 442 (1969).

Descriptors: *Water districts, *Alabama, *Administration, *Water management (Applied), Legislation, Legal aspects, Drainage systems, Water conservation, Water utilization, Water resources development, Agricultural engineering, Civil engineering, Eminent domain, Flood protection, Flood control, Right-of-way, Taxes, Assessments, Adjudication procedure, Supervisory control (Power).

The procedure for the organization of a water management district is prescribed. Upon the filing of a petition signed by a majority of the landowners owning more than one-third of the land in a proposed district, the probate court of the county in which the lands are located appoints a civil or agricultural engineer. The duties of the engineer are enumerated. A probate court hearing is conducted for the benefit of those realty owners affected by the proposed district. The water management district, once incorporated by the probate court, is authorized to exercise the powers of eminent domain for the purpose of securing adequate outlets, floodwater retarding structure sites, and such other necessary rights-of-way. The district is authorized to perform all acts necessary and proper for the carrying out of the district's purpose. The method of allocating costs and levying taxes to defray the organizational expenses of the district is set forth. (Powell-Florida)
W70-09793

SEWAGE FACILITIES--PERMITS--INSPECTION.
Penn Gen Laws Act No 43 (1970) (amending Pub Laws 1535).

Descriptors: *Pennsylvania, *Sewage disposal, *Sewerage, *Permits, Sewage, Environmental sanitation, Sewage districts, Legislation, Legal aspects, Sanitary engineering, Sewage treatment, Pipelines, State governments, Regulation.

The Pennsylvania Sewage Facilities Act is amended to include the definition of 'individual sewage system': a single system of piping, tanks or other facilities serving one or two lots and collecting and disposing of sewage in whole or in part into the soil of the property or into any waters of this Commonwealth. 'Rural residence' is defined as a structure occupied or intended to be occupied by not more than two families on a tract of land of ten acres or more. An individual or community sewage disposal system shall not be installed without a permit indicating that the site and the plans and specifications of such system are in compliance with the provisions of the Pennsylvania Sewage Facilities Act. Enumerated municipal and county departments are exempted from the permit requirement. (Powell-Florida)
W70-09794

ACT NO 479 (LEASE OF STATE HELD MINERAL, OIL AND GAS RIGHTS UNDER WATER).
Acts of Alabama, Act No 479 (1969).

Descriptors: *Leases, *Alabama, *Natural resources, *Beds under water, Conservation, Water resources development, Legislation, Legal aspects, Regulation, Exploitation, Oil fields, Mining, Navigable waters, Streams, Bays, Bayous, Lakes, Lake beds, Gulf of Mexico, Lagoons, Estuaries, Mineralogy, Oil, Natural gas.

Under the provisions of this Act, all lands proposed to be leased for oil, gas or mineral exploitation shall be leased only upon the basis of competitive bids. The procedure for the competitive bidding, as conducted by the Director of Conservation, is set forth. All revenue accruing from the lease of the bed of any navigable streams, waterways, bays, estuaries, lagoons, bayous, lakes, and any submerged lands in the Gulf of Mexico within the seaward boundary of Alabama shall become a part of the state's general funds. (Powell-Florida)
W70-09795

RIGGS V CITY OF SPRINGFIELD (ACTION TO ABATE TEMPORARY NUISANCE NOT BARRED BY STATUTE OF LIMITATIONS).
96 SW2d 392-400 (Mo Ct App 1936).

Descriptors: *Missouri, *Water pollution, *Sewage, *Remedies, Cities, Municipal wastes, Judicial decisions, Legal aspects, Local governments, Reasonable use, Waste disposal, Sewage treatment, Sewage disposal, Riparian rights, Pollution abatement, Damages, Adjudication procedure, Legislation, Streams.
Identifiers: Nuisance (Temporary), Nuisance (Permanent).

In 1893, defendant city erected a general sewer system whereby the untreated sewage from the city was discharged into a nearby creek. In 1913 and 1928, defendant city installed, remodeled and improved sewage plants. Plaintiff landowners brought an action for damages caused by the alleged failure of the defendant city to properly purify sewage emptying into the creek. The creek ran through the property of plaintiff landowners. Plaintiffs' case theory was that the city had established a temporary nuisance about one year after the completion of the 1928 plant. Defendant contended that the general sewer system had been maintained since 1893, thus giving defendant a prescriptive right to use the creek and barring plaintiffs' action because of the statute of limitations thereon. The Springfield Court of Appeals affirmed the trial court's decision for plaintiffs and held that the complaint was not barred where the nuisance was temporary or abatable and not permanent. The dissenting opinion argued that a permanent injury was created in 1893 and plaintiffs would have been entitled to consequential damages only had they instituted a suit within the statutory period. (Powell-Florida)
W70-09825

AMERICAN RED CROSS V HINSON (ELEMENTS REQUIRED TO ESTABLISH NAVIGABILITY FOR FEDERAL LAW PURPOSES).

122 SW2d 433-435 (Tenn 1938).

Descriptors: *Tennessee, *Jurisdiction, *Navigable rivers, *Overflow, Non-navigable waters, Judicial decisions, Legal aspects, Levees, Flooding, Floods, Navigable waters, Mississippi River, Admiralty, Federal government, Federal jurisdiction, Legislation, State jurisdiction, Water courses (Legal).

Plaintiff widow sued defendant under the Tennessee Workmen's Compensation Law for the accidental death of her husband arising out of and in the course of his employment. The place of the accident was within a levee on the Arkansas side of the Mississippi River, but some distance from the river bank. The area was usually dry land and was covered with water only during flooding. Defendant contended the accident occurred on navigable water and that any recovery by plaintiff must be had under the Federal Longshoreman and Harbor Workers' Compensation Act or the Jones Act. The court agreed with the trial judge that the accident took place on overflowed lands, not navigable waters, and that plaintiff was entitled to recover under state law. To constitute a navigable stream the seasons of navigability must occur regularly and be of sufficient duration to serve a useful public purpose for commercial intercourse. The judgment for plaintiff was affirmed. (Price-Florida)
W70-09834

WATER-SUPPLY STRINGENCIES-FEATURES ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
For primary bibliographic entry see Field 06B.
W70-09852

RAULS V COSTNER (DRAINAGE DISTRICT'S LIABILITY FOR FLOOD WATERS CAUSED BY ERECTION OF NEW LEVEE).

143 SW2d 1090-1094 (Ark 1940).

Descriptors: *Arkansas, *Levees, *Drainage districts, *Flood damage, Dams, Surface drainage, Water injury, Flooding, Compensation, Remedies, Flood control, Judicial decisions, Adjudication procedure, Legal aspects, Water law, Riparian water, Riparian land, Natural flow doctrine, Streamflow, Rivers, Navigable rivers, Surface water, Lakes, Streams, Impounded waters.
Identifiers: *Servitudes.

Plaintiff landowner brought an action against defendant drainage district for damages to plaintiff's land caused by the construction of a new levee. The levee raised the water level adjacent to plaintiff's land, subjecting it to increased flooding at times of high water. Plaintiff contended that his property was protected from flood waters by the old levee but not by the new levee. Defendant argued that there was insufficient evidence to support plaintiff's contentions and that there could be no liability for leaving riparian land exposed to floods, a natural servitude of such land. Reversing a judgment for plaintiff, the court held that a riparian owner takes his land subject to possible flood damage, and a drainage district is not liable for such damage unless it can be shown that the levee has caused the flood waters to be permanently impounded on plaintiff's land. (Liptak-Florida)
W70-09895

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif.
Research and Development Lab.
For primary bibliographic entry see Field 06A.
W70-09908

STRECKFUS STEAMERS, INC V KEITEL (MISSISSIPPI RIVER EMPLOYEES NOT EXEMPT FROM UNEMPLOYMENT TAX AS AN EXCISE ON THE USE OF THE RIVER).

182 SW2d 587-589 (Mo 1944).

Descriptors: *Mississippi River, *Navigation, *Taxes, *Employment, Missouri, Navigable rivers, Tariff, Boats, Unemployment, Compensation, Insurance, Welfare (Economics), Occupations, Personnel, Administrative agencies, Administrative decisions, Interstate rivers, Transportation, Highways, Ships, Cruises, Judicial decisions, Legal aspects, State governments, Legislation.

Plaintiff steamboat operator sought judicial review of a decision by defendant unemployment compensation commissioner to the effect that plaintiff's employees were subject to state unemployment compensation tax. Plaintiff contended that since both the Missouri constitution and federal law provide that the Mississippi River is a public highway

d that use of the river should be free to all thout any tax, duty, or toll, his employees who erated boats on the river were exempt from the k. Defendant contended that the tax was on em- yment, not navigation of the river, and hence as not a toll for use of the river but a general tax posed on all citizens engaged in any kind of em- yment. Reversing a lower court judgment for aintiff, the Supreme Court of Missouri held that e fact that plaintiff's employees happened to rk on the river did not convert the unemploy- ent tax into a tax upon the use of the river, nor d it exempt them from the imposition of the tax. iptak-Florida)
70-09912

ENTUCKY GAME AND FISH COMM'N v URNETT (STATE FISH COMMISSION'S LIA- ILITY FOR FLOOD DAMAGE CAUSED BY RECTION OF DAM FOR FISH HATCHERY).
90 Ky 786, 163 SW2d 50-53 (1942).

escriptors: *Kentucky, *Dams, *Flood damage, Fish hatcheries, State governments, Administra- ve agencies, Backwater, Water injury, Compensa- on, Condemnation, Condemnation value, minent domain, Streams, Judicial decisions, Legal spects, Adjudication procedure, Water law, ublic rights, Property values, Land appraisal, looding, Damages, Access routes.

laintiff landowner brought an action against de- endant state game and fish commission for amages resulting from defendant's construction of dam and a fish hatchery. The construction caused artial flooding of plaintiff's land and the destruc- on of a creek ford which was plaintiff's means of ngress and egress. Plaintiff argued that he was enti- led to damages and an injunction restraining de- endant from maintaining the dam. Defendant con- ested the proof of damages. Affirming a judgment or plaintiff on the damages and for defendant on he injunction, the Court of Appeals of Kentucky eld that conflicting proof of damages was properly ubmitted to the jury. As to the injunction, the ourt pointed out that the damage award was tan- amount to a condemnation and, upon satisfaction f the judgment, defendant would be vested with he right to maintain the dam in its present condi- ion. (Liptak-Florida)
W70-09913

RUST V CITY OF NEWPORT (CITY'S LIABILI- TY FOR WATER DAMAGE TO PROPERTY ALONG NEW ROAD CONSTRUCTION).
284 Ky 567, 145 SW2d 511-512 (1940).

Descriptors: *Kentucky, *Road construction, *Set- tlement (Structural), *Surface runoff, Diversion, Drainage water, Cities, Local governments, Adju- dication procedure, Judicial decisions, Legal aspects, Damages, Roads, Paving, Washouts, Sub- sidence, Flood damage, Water injury, Surface drainage, Adjudication procedure.

Plaintiff landowner brought an action against de- fendant city to recover damages to plaintiff's house. The damage was allegedly caused by diver- sion of water onto plaintiff's property by defen- dant's street construction. Plaintiff contended that the street was so negligently constructed as to cause water to collect on his property, resulting in settlement and cracking of his floor and walls. De- fendant denied the negligence and offered proof of other causes of plaintiff's damage. Affirming a judgment for defendant, the court held it would not overturn the jury's verdict when there was suffi- cient evidence to support it, especially when the jury had viewed the premises. (Liptak-Florida)
W70-09931

KYLE V ST FRANCIS LEVEE DIST (LEVEE DISTRICT'S LIABILITY FOR WATER DAMAGE CAUSED BY INTERFERENCE WITH SURFACE DRAINAGE).
153 SW2d 391-393 (Mo Ct App 1941).

Descriptors: *Missouri, *Repulsion (Legal aspects), *Levees, *Surface runoff, Water injury, Damages, Judicial decisions, Legal aspects, Dikes, Flood control, River regulation, Underseepage, Mississippi River, Surface waters, Drainage water, Rain water, Surface drainage, Standing waters, Cultivated lands, Arable land, Federal government, Administrative agencies, Land tenure, Saturated soils.
Identifiers: *Levee districts.

Plaintiff landowner brought an action against defendant levee district to recover damages for water injury to his property. The damage was allegedly caused by the erection of a new levee which interfered with the natural surface drainage of plaintiff's property. Plaintiff contended that his property had been useful for farming since the construction of the old levee, but that the new levee had interfered with his natural drainage, making his fields soggy and swampy. Defendant denied the injury to the property and argued that the federal government had built the new levee and should be liable for damage caused thereby. Reversing a judgment for plaintiff, the court noted that plaintiff's land was obviously damaged, but held that since defendant had not built and did not own the levee, but merely maintained it, defendant could not be liable for injuries caused by the construction. (Liptak-Florida)
W70-09940

STEWART V CITY OF SPRINGFIELD (CONSTRUCTIVE CONDEMNATION OF A STREAM BY POLLUTION).

165 SW2d 626-631 (Mo 1942).

Descriptors: *Missouri, *Condemnation, *Local governments, *Water pollution, Appropriation, Community development, Eminent domain, Human population, Judicial decisions, Legal aspects, Proprietary power, Public rights, Relative rights, Riparian land, Riparian rights, Riparian waters, Sewage districts, Watercourses (Legal), Pollution abatement, Damages, Sewage, Remedies.
Identifiers: *Nuisance (Legal).

Defendant city built sewers which emptied into and polluted a stream which flowed through plaintiffs' lands. In three separate suits, plaintiffs brought actions against defendant for creating an abatable temporary nuisance. Plaintiffs received judgments in each case. Defendant reserved the right to raise any defenses it might have in future suits. In a fourth suit defendant claimed that it had long since appropriated the use of the creek under its right of eminent domain and that the statute of limitations had run against all of plaintiffs' claims. Plaintiffs asserted that defendant was estopped to use this defense. The court held that since previous judgments could not estop plaintiffs from future claims of permanent damages, they did not estop the city from asserting its permanent appropriation. The court further held that a municapality could, and in this case did, appropriate a stream for sewer purposes without instituting proceedings to condemn it by eminent domain. Normally, riparian owners would be entitled to full compensation for damages to their land caused thereby. In the case, however, the statutory period for filing for such damages had run. (Clarke-Florida)
W70-09979

MADDOX V INTERNATIONAL PAPER CO (PAPER MILL'S LIABILITY FOR FISHKILL CAUSED BY WATER POLLUTION).

47 F Supp 829-832 (WD La 1942).

Descriptors: *Louisiana, *Water pollution, *Pulp wastes, *Fishkill, Commercial fishing, Acid streams, Pollution abatement, Riparian rights, Pollutants, Water pollution effects, Remedies, Legal aspects, Water law, Adjudication procedure, Judicial decisions, Legislation, Riparian waters, Industrial wastes, Pulp and paper industry, Pulp wastes.

Plaintiff fishing camp operator sought damages and an injunction because of defendant paper company's operations which polluted the water, killing the fish and destroying plaintiff's fishing business. Plaintiff contended that defendant paper company, being an upstream owner, was liable for any damage suffered by downstream owners caused by the discharge of acids and other pollutants from defendant's settling basins. Defendant argued that plaintiff could not recover for the death of the fish because fish are property of the state and not subject to private ownership. The court held that, since under the Louisiana Code every act which causes damage to another is the proper subject of reparation, plaintiff was entitled to recover for lost profits. However, with an adequate remedy at law, plaintiff was not entitled to an injunction. The court also noted that defendant's efforts to prevent the pollution would protect it from punishment, but were no defense to an action for damages. (Liptak-Florida)
W70-09980

HAMPTON V NORTH CAROLINA PULP CO (ACTION TO RECOVER FOR FISHKILL CAUSED BY PULP WASTES).
49 F Supp 625-632 (ED NC 1943).

Descriptors: *North Carolina, *Fishkill, *Commercial fishing, *Water pollution effects, Commercial fish, Stream fisheries, Fishing, Spawning, Fish reproduction, Fish migration, Riparian rights, Usufructuary right, Water pollution, Wastes, Pollutants, Water pollution sources, Damages, Judicial decisions, Legal aspects, Remedies.

Plaintiff riparian landowner brought an action against defendant company to recover for lost revenue caused by defendant's destruction of fish. Defendant's pulp plant discharged certain amounts of waste products into the river, and plaintiff claimed his fisheries were deprived of their expected catch. The United States District Court for the Eastern District of North Carolina ruled that plaintiff had no interest in the fish before reduction to acual possession, but had only a right to fish in the river in common with the public. The case was dismissed. (Barker-Florida)
W70-09981

UNITED STATES V FLORIDA POWER AND LIGHT CO (INJUNCTION AGAINST THERMAL POLLUTION).
311 F Supp 1391-1392 (SD Fla 1970).

Descriptors: *United States, *Florida, *Thermal pollution, *Electric powerplants, Facilities, Water pollution, Heated water, Pollutants, Pollution abatement, Temperature, Governments, Legislation, Remedies, Aquatic life, Damages, Judicial decisions, Legal aspects, Adjudication procedure.
Identifiers: *Biscayne Bay.

The United States sought a temporary injunction against defendant power company to prevent further discharge of heated water into Biscayne Bay, Florida. Plaintiff contended that such thermal pollution was dangerous to the marine life of the bay. The United States District Court for the Southern District of Florida held that even though injunctive relief in such a case was proper under the Rivers and Harbors Act, the injunction would not be issued in the absence of a showing of irreparable harm. Such irreparable damage not having been proved, the injunction was not granted. (Barker-Florida)
W70-09982

INTERNATIONAL SHOE CO V HEATWOLE (PRIVATE CAUSE OF ACTION FOR POLLUTION).

30 SE 2d 537-541 (W Va 1944).

Descriptors: *West Virginia, *Water pollution, *Riparian rights, *Riparian waters, Judicial deci-

sions, Legal aspects, Impaired water quality, Nonconsumptive use, Pollution abatement, Streams, Pollutants, Reasonable use, Wastes, Water pollution effects, Industrial wastes, Chemical wastes, Industrial plants, Industrial production, Competing uses, Industrial water, Aesthetics, Jurisdiction, Recreation, Relative rights, Remedies.

Plaintiff landowner, in an action brought before a justice of the peace, sought compensation for damages allegedly caused by defendant industry's discharge of waste into a river abutting plaintiff's property. Damages alleged included discoloration of the water, interference with fishing in the river, and a decrease in value of plaintiff's property. The justice held for plaintiff. Defendants sought a writ of prohibition in the Supreme Court of Appeals of West Virginia to forbid the enforcement of the judgment. Defendants contended that pollution of a stream is a public wrong creating no cause of action enforceable by a riparian owner and that no private damage was done plaintiff. The court held that pollution of a river is a public wrong and, to recover damages, a riparian owner must show damage of a different character than that of the public at large. A riparian owner has not proprietary right in a river's beauty, nor does he have an exclusive right to fish or bathe. Plaintiff would have had a right of action if sediment from defendant's plant had been deposited on his land. However, since plaintiff nowhere alleged that his use of his land was interfered with, the judgment in his favor was improper. A writ of prohibition was issued forbidding enforcement of the judgment. (Dye-Florida)
W70-09983

UNITED STATES V 25.4 ACRES OF LAND (OWNERSHIP OF RIPARIAN LAND CREATED BY LANDFILL--CONDEMNATION PROCEEDINGS).
52 F Supp 75-89 (ED NY 1943).

Descriptors: *United States, *New York, *Land tenure, *Condemnation, Cities, Riparian land, Land, Real property, Eminent domain, Governments, Compensation, Bulkheads, Landfills, High water mark, Low water mark, Ownership of beds, Boundaries (Property), State governments, Judicial decisions, Legal aspects, Boundary disputes.

In a condemnation proceeding, the State of New York and the City of New York objected to the payment of certain awards to the alleged owners of the condemned property. Both governments challenged the titles of the owners and claimed that title had remained vested in the respective governments. A portion of the land in question had originally been underwater, but had been bulkheaded and filled by the predecessors in title of the alleged current owners. The United States District Court, Eastern District of New York, ruled that an examination of both the grants and subsequent possesstion of the land in question showed good title to be in the alleged owners, not in either of the governments. The full condemnation awards were given the owners. (Barker-Florida)
W70-09984

CHICK SPRINGS WATER CO V STATE HIGHWAY DEPT (STATE'S LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT CULVERT CONSTRUCTION).
183 SE 27-33 (SC 1935).

Descriptors: *South Carolina, *Flood damage, *Culverts, *Compensation, Highways, Rainfall, Cloudbursts, Legal aspects, State governments, Condemnation, Eminent domain, Judicial decisions, Adjudication procedure, Drains, Drainage effects, Flooding, Floods, Administrative agencies, Storm runoff, Water injury, Highway effects, Highway relocation, Road construction, Roadbanks, Remedies.

Plaintiff water company brought an action for damages against defendant state highway department for flood damage caused by the inability of a culvert, built by defendant, to carry off rain water. Plaintiff contended that the culvert was negligently constructed in the first place, and after one flooding, plaintiff had warned defendant that further flooding was imminent. Plaintiff argued that the failure to enlarge the culvert was a taking of property for public use. Defendant contended that the matter was res judicata since plaintiff had already brought an action for the negligent construction of the culvert which action resulted in a verdict for defendant on the ground that the rainstorm was an unprecedented act of God. Reversing an order sustaining defendant's demmurer, the court held that there is no identity of causes of action when one action is brought for the creation of a nuisance and another is brought for the maintenance of a nuisance. The court reasoned that even if the first rainstorm was unprecedented in defendant's experience, plaintiff's subsequent warnings put defendant on notice and under a duty to maintain the culvert so as to prevent further damage to plaintiff's land. One justice dissented. (Liptak-Florida)
W70-09985

IN RE CAVANAUGH (CITY'S LIABILITY UNDER EMINENT DOMAIN FOR SUBSIDENCE DAMAGE CAUSED BY SEWER CONSTRUCTION).
183 A 360-363 (Pa Super Ct 1936).

Descriptors: *Pennsylvania, *Sewers, *Land subsidence, *Trenches, Condemnation, Eminent domain, Compensation, Adjudication procedure, Judicial decisions, Legal aspects, Cities, Local governments, Excavation, Damages, Settlement (Structural), Storm runoff, Washouts, Remedies, Drainage effects, Cloudbursts, Excessive precipitation.
Identifiers: Causation (Legal).

Plaintiff landowners sought damages for injury to their property caused by defendant city's sewer construction. Defendant had dug a trench adjoining plaintiffs' property and a rainstorm had filled the trench with water. This undermined plaintiffs' property, causing it to subside. Plaintiffs contended that the damage was a direct and unavoidable result of defendant's construction of the sewer. Defendant contended that the damage proceedings were improper because the rainstorm was an act of God and that, as a matter of law, defendant should not be liable unless negligence was shown. Affirming the dismissal of defendant's appeal, the court held that although the question of the propriety of the proceedings was for the court, the question of proximate cause was properly for the jury's determination. Thus, it was proper for the trial court, in reviewing the referee's findings, to determine whether the damage was the necessary result of digging the trench or an act of God. (Liptak-Florida)
W70-09986

PARKS V BENNING (LEASE OF OYSTER BEDS).

188 A 787-790 (Md 1937).

Descriptors: *Maryland, *Oysters, *Leases, *Beds under water, Beds, Ownership of beds, River beds, Governments, Legislation, Relative rights, Land tenure, Riparian land, Rent, Remedies, Judicial decisions, Legal aspects, Water law, Local governments, Third party effects, Shellfish, Commercial shellfish.

Plaintiff riparian landowner sought an injunction against defendant's lease of an oyster bed. A Maryland statute provided for such leases, but only to bona fide residents of the state. Plaintiff claimed that defendant was merely a 'straw man' and that another party, not a resident, was to be the beneficiary of the lease. Defendant argued that his part-time employment by the third party had no relation to the lease of the bed and the fact that the third party, on whose land the beds fronted, had paid the first year's rent was merely coincident with their acquaintance. The trial court enjoined the lease but the Court of Appeals of Maryland reversed, saying that the friendship between the nonresident riparian landowner and the lessee of a oyster bed in front of his land did not violate the law which preserved such leases to residents only. (Barker-Florida)
W70-09987

STAMFORD DOCK AND REALTY CORP CITY OF STAMFORD (CITY'S LIABILITY FOR SEDIMENT DISCHARGE FROM STORM DRAINS AND SEWERS).
124 Conn 341, 200 A 343-346 (1938).

Descriptors: *Connecticut, *Sewers, *Navigation, *Sediment discharge, Local governments, Storm runoff, Drains, Drainage effects, Silts, Sediments, Water pollution, Navigable water, Transportation, Cities, Legal aspects, Adjudication procedure, Judicial decisions, Public rights, Municipal wastes, Canals, River basins, Damages, Compensation, Silting, Remedies.
Identifiers: Governmental immunity.

Plaintiff shipping company sought to enjoin defendant city from maintaining its storm drains and sewers so as to allow silt and other refuse to discharge into the navigable basin where plaintiff carried on its business, thereby causing the basin to fill up with sediment and be unfit for navigation. Plaintiff contended that the obstruction of the basin was a public and private nuisance which defendant should be required to correct. Defendant argued that the maintenance of the storm drains and sewers was a governmental function, that it was immune to liability for negligence, and that the silt and other refuse were results of acts of God. Affirming a judgment for defendant, the court held that it could not be said as a matter of law that the damage to plaintiff's property and business was not caused by an act of God. Moreover, governmental immunity was a good defense against a claim of negligence whether or not the negligence resulted in a nuisance. (Liptak-Florida)
W70-09988

COMMONWEALTH EX REL BARD V DELAWARE DIVISION CANAL CO (RESTRICTIONS ON CANAL COMPANY'S USE OF PROPERTY ARE NOT CONDITIONS OF TITLE).

332 Pa 53, 1 A2d 672-677 (1938).

Descriptors: *Pennsylvania, *Canals, *Land tenure, *Navigation, Competing uses, Industrial use (Water), Legislation, State governments, Adjudication procedure, Judicial decisions, Legal aspects, Water law, Water rights, Public rights, Transportation, Real property, Water quality, Highways, Navigable waters, Reasonable use, Consumptive use.

Plaintiff state of Pennsylvania sued defendant canal company for a decree of forfeiture revesting in the state title to land previously conveyed to defendant for use as a canal. Plaintiff contended that the terms of the conveyance limited use of the land to canal purposes and imposed a condition upon the title which should cause a forfeiture. Defendant had discontinued using the property for canal purposes. Plaintiff argued alternatively that the restrictive terms of the deed should be taken as covenants, and defendant should be required to restore the canal to navigable capacity. Defendant contended that mere declarations of purpose do not impose conditions upon title and that later legislation specifically authorized canal companies to use their water supply for other commercial purposes. Affirming a decree in favor of defendant, the court held that attempted restrictions on titles are strictly construed in favor of free alienation and that conditions on titles must be clearly stated. The court further noted that the terms of the deed referred to defendant's status as a common carrier, and defendant was no longer engaged in that business. In

ght of specific enabling legislation, defendant was ithin its rights to make other uses of its water pply so long as defendant did not pollute the aters or otherwise maintain the water supply so as o create a nuisance. (Liptak-Florida)
/70-09989

ILGRIM PLYWOOD CORP V MELENDY (LIA-ILITY FOR OBSTRUCTION OF ACCESS OAD CAUSED BY DAM BACKWATER).
A2d 700-703 (Vt 1938).

escriptors: *Vermont, *Access routes, *Dams, Backwater, Lumbering, Roads, Condemnation, ublic utilities, Adjudication procedure, Judicial ecisions, Legal aspects, Public rights, Water law, emedies, Flood damage, Local governments, nited States, Cities, Eminent domain, Real pro-erty, Hydroelectric plants, Streams, Highway relo-ation, Damsites.
dentifiers: Injunction.

laintiff lumber company sued defendant board of ublic works to enjoin the closing of a dam which ould cause flooding of the only road leading to laintiff's timber land. Plaintiff contended that no roceedings had been instituted to acquire the right o flood the public highway, that the only land uitable for an alternate access route to plaintiff's roperty had been acquired by defendant under the tate's eminent domain powers, and that defendant ad represented that an alternate access route ould be provided. Defendant contended that laintiff failed to establish that the flooding was an llegal act as to plaintiff and that there was an dequate remedy at law since plaintiff could peti-ion the town to provide an access road to the pro-erty. Reversing a decree in defendant's favor, the ourt noted that the obstruction or destruction of a ublic road could be enjoined as a nuisance if laintiff could show some special injury and held hat cutting off plaintiff's only means of ingress and gress from his property was such a special injury. The court also noted that the remedy at law was in-dequate since plaintiff would be required to pay a substantial portion of the cost of a road obtained by petition. However, the court held that injunctive relief should be delayed to give defendant reasona-ble opportunity to acquire, if possible, the right to flood the road. (Liptak-Florida)
W70-09990

MORTON V BOROUGH OF DORMONT (CI-TY'S LIABILITY FOR DAMAGE CAUSED BY INCREASE IN NATURAL FLOW OF SURFACE WATER).

5 A2d 803-804 (Pa 1939).

Descriptors: *Pennsylvania, *Sewers, *Drainage water, *Riddance (Legal aspects), Eminent domain, Damages, Remedies, Compensation, Local governments, Cities, Legal aspects, Judicial decisions, Water law, Adjudication procedure, Surface waters, Surface runoff, Flood damage, Water injury, Surface drainage, Storm drains, Natural streams, Artificial watercourses, Drainage effects.

Plaintiff property owner brought an action for damages against defendant city. The claim arose from water damage to plaintiff's farm caused by defendant's construction of storm sewers which increased the natural flow of surface water across plaintiff's land. Plaintiff contended that a city should be liable for artificial improvements which collect surface water and discharge it onto servient land with such force as to cause flood damage. Defendant contended that there was no compensable injury to plaintiff since the sewers were constructed pursuant to the city's lawful authority. On plaintiff's appeal from a nonsuit, the court noted that a city could not be held liable for improvements which merely increased the flow of surface water in its natural watercourse. However, the city would be liable if the increased flow were discharged at some point on the servient land where the water would not have been naturally discharged. Therefore, the court reversed the judgment of nonsuit and remanded the case to determine whether the damage to palintiff's land fell within the rule of liability. (Liptak-Florida)
W70-09991

GRAF V CITY OF NEWARK (CANAL COMPANY'S AUTHORITY NOT LIMITED TO NAVIGATION WHEN CONSIDERING CONDITIONAL TITLE).
124 NJL 312, 11 A2d 764-766 (1940).

Descriptors: *New Jersey, *Canals, *Land use, *Land tenure, Cities, Legislation, Judicial decisions, Real property, Highways, Transportation, Navigation, Condemnation, Eminent domain, Compensation, Local governments, Legal aspects, State governments, Public rights.

Plaintiff's ancestor conveyed land to a canal company. The land was to be used pursuant to the canal company's statutory authority. Defendant city acquired the property after the canal company had abandoned the canal, and the city used the property for a public road. Plaintiff sued defendant for damages for taking of the property and contended that the land should have reverted when it was no longer used for navigation. Although the canal company's charter limited its powers to canal purposes, the court held that the canal was a public highway and its use was not limited to transportation by water. The court also noted that legislation authorizing cities to acquire the canal property was tantamount to an amendment of the company's charter, and the state's abandonment of the canal did not presume a relinquishment of the state's rights in the property. (Liptak-Florida)
W70-09992

WEBBER V POLICE JURY (TITLE TO LAND IN ABANDONED DRAINAGE DISTRICT).
48 F Supp 350-357 (WD La 1943).

Descriptors: *Louisiana, *Drainage districts, *Land tenure, *Canals, Real property, Land, Land use, Administrative agencies, Levees, Drainage, Governments, Public lands, Public rights, Ditches, Administrative decisions, Flood control, Economics, Local governments, Remedies, Judicial decisions, Legal aspects.

Plaintiffs, owners of lands encompassed by a previously abandoned drainage sub-district, sought to have title to a canal and levee on one boundary of the property declared to be in them. Plaintiffs claimed that the title had been transferred by the board of commissioners of the parent drainage district when the smaller project was abandoned. Defendant police jury argued that no such transfer was made and that the original grants of the land in question reserved such land for public use. The United States District Court for the Western District of Louisiana ruled that the parent drainage district had expressly not conveyed the entire canal or the levee to palintiffs and that defendants acted properly in treating the land as publicly owned. Plaintiffs' suit was dismissed. (Barker-Florida)
W70-09993

UNITED STATES V CERTAIN LANDS IN TOWN OF HIGHLANDS (FEDERAL GOVERNMENT'S CONDEMNATION OF LAND CONSTITUTING A LOCAL WATERSHED).
48 F Supp 306-308 (SD NY 1942).

Descriptors: *Condemnation, *Watersheds (Divides), *Federal government, *Water supply, Watershed management, New York, Eminent domain, United States, Governments, Water law, Legal aspects, Legislation, Water rights, Cities, Judicial decisions, Land use, Local governments, Public utilities.

The United States sought to condemn and acquire certain land to be used for expansion of the West Point military reservation. The expansion was pursuant to an act of Congress which provided that nothing in the act should be taken to adversely affect the water supply of a nearby town. The town's only water company intervened in the condemnation proceedings and contended that, although it owned none of the property to be condemned, the property was a large part of the watershed and supplied a large part of the company's and the town's water supply. The company argued that the act's proviso prohibited a taking of such land. The Secretary of War expressly disclaimed any intent to acquire any of the company's rights, title, or interest in any of the land. The court held that the Secretary's disclaimer gave the water company all the protection it needed. The court reasoned that Congress intended to protect the town's water supply and that it could be be assumed that the Army's presence would adversely affect the watershed any more so than that of the present owners. (Liptak-Florida)
W70-09994

GULF OIL CORP V THE BALTIMORE (DREDGE COMPANY'S LIABILITY FOR OBSTRUCTION OF NAVIGABLE CHANNEL).
47 F Supp 770-773 (ED NY 1942).

Descriptors: *New York State Barge Canal, *Navigation, *Channel improvement, *Boulders, New York, Adjudication procedure, Excavation, Channels, Open channels, Navigable waters, Admiralty, Ships, Dredging, Legal aspects, Judicial decisions, Water law.

Plaintiff oil company sued defendant dredge company in admiralty for damages to plaintiff's ship. The ship had collided with a rock left by defendant's dredging operations in the New York State Barge Canal. Plaintiff contended that defendant had a duty, under its contract with the state, to sweep the channel after dredging operations to locate and correct any obstructions to navigation. Defendant contended that the rock might have fallen from the bank and not been dislodged by defendant's dredging operation. Defendant argued further that plaintiff was negligent in not navigating the center of the old channel. The court held that, once plaintiff had shown sufficient facts to make out a case, the burden was on defendant to explain the obstruction in an area which defendant had a duty to keep open for navigation. The court also noted that plaintiff's failure to use the center of the old channel was not negligence since the purpose of dredging and widening the canal was to make it safe for passage at points other than the old center. (Liptak-Florida)
W70-09995

GALLERANI V UNITED STATES (DAMAGE TO WELL FROM CANAL IMPROVEMENT).
41 F Supp 293-294 (D Mass 1941).

Descriptors: *United States, *Massachusetts, *Damages, *Percolating water, Subsurface water, Wells, Canals, Navigation, Legislation, Land tenure, Remedies, Judicial decisions, Legal aspects, Governments, Drawdown, Eminent domain, Compensation, Relative rights.
Identifiers: *Cape Cod Canal.

Plaintiff landowner brought suit against the United States for an alleged 'taking' of his property. The United States had appropriated land adjacent to plaintiff's property for the purpose of improving the Cape Code Canal, and subsequent to the improvement operations, a well on plaintiff's land dried up. The United States District Court for Massachusetts ruled that the taking of the adjacent land was a proper purpose, that there was no property right in the underground percolating waters, and that any injury resulting from the loss of such water through the lawful acts of an adjoining landowner must be considered damnum absque injuria. The United States' motion to dismiss was granted. (Barker-Florida)
W70-09996

OAKLAND CLUB V SOUTH CAROLINA PUBLIC SERVICE AUTH (SUIT TO ENJOIN CONDEMNATION OF PROPERTY FOR A DAMSITE).

30 F Supp 334-341 (ED SC 1939).

Descriptors: *South Carolina, *Condemnation, *Legislation, *Damsites, Remedies, Dams, Hydroelectric plants, Payment, Costs, Federal Power Act, Administrative agencies, Eminent domain, Land tenure, Legal aspects, Project purposes, Reservoirs, Judicial decisions, Damages, Permits, Federal project policy, Compensation, Reservoirs, Reservoir construction, Adjudication procedure.
Identifiers: *Constitutionality, Injunction.

Plaintiff sought to enjoin the defendant public service authority from condemning plaintiff's land for a damsite. As the defendant was acting under authority of both a state statute and the Federal Power Act, plaintiff claimed that the Federal statute pre-empted defendant's condemnation powers under state law. Both this claim and defendant's argument that the state statute was unconstitutional, in not setting up a proper method of payment, were rejected by the court. The court upheld the state law, which provided for compensation to be initially fixed by a panel of referees with the condemnee having a right of a de novo jury trial if he were dissatisfied with the award. The plaintiff also argued that the federal statute only provided for condemnation of 'damsites', which could not include land to be covered by the reservoir backed up by the dam. The court rejected this argument also, holding that the common usage of the term 'damsite' included the resulting reservoir. (Caldwell-Florida)
W70-09997

UNITED STATES EX REL TVA V VOGLE (UNITED STATES' CONDEMNATION OF MINERALS FOR TVA PURPOSES).

28 F Supp 454-455 (WD Ky 1939).

Descriptors: *Tennessee Valley Authority Project, *Condemnation, *Damsites, *Eminent domain, Land use, Federal government, Federal project policy, Legal aspects, Judicial decisions, Mining, Quarries, Dams, Dam construction, Concrete dams, Reservoirs, United States, Legislation, Adjudication procedure, Limestones, Public rights, Public utilities, Land tenure, Compensation.

The United States petitioned to condemn respondent's property for use by the Tennessee Valley Authority. Respondent contested the authority to condemn that part of his property which would not be flooded by the proposed reservoir but would be used to mine limestone rock for construction of the dam. Respondent contended that property not needed directly for the dam was not necessary and could not be condemned. The court held that it could pass only on what constituted a public taking and that the question of the necessity of a particular taking was for the legislature. Therefore, the court was without power to review the government's decision that this property was necessary for the purposes of the Tennessee Valley Authority. (Liptak-Florida)
W70-09998

UNITED STATES V 80 ACRES OF LAND (AUTHORITY FOR CONDEMNATION).
26 F Supp 315-322 (ED 111 1939).

Descriptors: *United States, *Eminent domain, *Multiple-purpose projects, *Condemnation, Legislation, Governments, Soil converation, Water conservation, Erosion control, Forest management, Project purposes, Forestry, Water pollution control, Flood control, Federal project policy, Public benefits, Administration, Administrative agencies, Economic impact, Compensation, Remedies, Judicial decisions, Legal aspects, Social aspects.
Identifiers: *Constitutionality.

In a condemnation proceeding the United States sought to acquire defendants' land which lay within the area to be affected by a project under the National Industrial Recovery Act. Defendants moved to dismiss on the grounds that the statutes were unconstitutional and that the proposed project was not properly within the definition of the public purpose doctrine. The United States District Court, Eastern District of Illinois, found that the project was designed for the purposes of conservation, pollution control, forestation, flood control, and unemployment relief, and was therefore clearly within the scope of public purpose. The court further ruled that the statute was constitutional. The motion to dismiss was denied. (Barker-Florida)
W70-09999

FRANKLIN V UNITED STATES (CONSEQUENTIAL DAMAGES FROM NAVIGATION IMPROVEMENT).

16 F Supp 253-260 (WD Tenn 1936).

Descriptors: *United States, *Mississippi River, *Alteration of flow, *Navigation, Tennessee, Navigable rivers, Projects, Legislation, Structures, Dikes, Obstruction to flow, Riparian rights, Riparian land, Damages, Flood damage, Relative rights, Governments, Channels, Eminent domain, Remedies, Judicial decisions, Legal aspects.

Plaintiffs sought recovery for damages caused their lands by flooding which was the result of a navigational improvement project on the Mississippi River. Defendant United States had erected dikes in the river upstream and across from plaintiffs' lands and had thereby changed the channel so that it was forced against the lands. Plaintiffs argued that the resulting flooding of their property was a taking within the meaning of the fifth amendment. Citing a long line of cases concerning governmental liability for navigation projects, the United States District Court for the Western District of Tennessee ruled that the damages to plaintiffs' lands were consequential, thus relieving the United States from liability. The court accepted the principle that riparian ownership on navigable waters is subject to the obligation to suffer the consequences of an improvement of the navigation by the United States. (Barker-Florida)
W70-10000

STATE V ADELMEYER (STATE'S RIGHT TO FLOW RIPARIAN LAND).
265 NW 838-848 (Wis 1936).

Descriptors: *Navigable waters, *Wisconsin, *Riparian rights, *Compensation, Judicial decisions, Legal aspects, Legislation, Eminent domain, Condemnation, Flow, Natural flow, Riverflow, Dams, Marshes, Land, Arable land, Land forming, Land use, Rivers, Governments, State governments, Riparian land, Flooding, Obstruction to flow, Reclamation, Alteration of flow.

Property owned by defendants comprised what once was a marsh. Defendants privately and individually constructed facilities which changed the course of a river, thus transforming the marsh into usable farmland. Twenty years after this transformation plaintiff state dammed the river, which again created a marsh, for the purpose of establishing a wildlife sanctuary. No compensation was made to landowners whose land was again inundated. Plaintiff sought a declaratory judgment to determine the rights of all parties in the marsh. Plaintiff contended that defendants had no right to change the course of a navigable river. Defendants answered that the state's acquiescence in the change estopped it from complaining or returning the river to its natural course without compensating defendants. The Supreme Court of Wisconsin ruled for defendants. The court found that the landowners' action had increased the navigability of the river and that the uncovered lands had taken on a new value and character. Consequently, the state could not flow such lands, despite the fact that the lands were naturally marsh, without compensatiri the owners. The measure of compensation wa stated to be the difference between the values the inundated and uninundated lands. (Dy Florida)
W70-10001

NELSON V DE LONG (DEPRIVATION O RIPARIAN RIGHTS APPURTENANT TO AL KESHORE PROPERTY).
7 NW2d 342-350 (Minn 1942).

Descriptors: *Minnesota, *Cities, *Lakes, *Regu lation, Docks, Real property, Riparian rights Riparian land, Judicial decisions, Legal aspects Shores, Navigable waters, Easements, Condemna tion, Recreation, Boats, Boating, Boating regula tions, Permits, Local governments, Legislation Navigation, Public rights, State governments, Su pervisory control (Power).

Plaintiff, though not a riparian landowner, ha been conveyed certain riparian rights which al lowed the use of docks, boathouses and th shorefront of a lake. Due to increased usage of th shorefront by plaintiff and others, defendant villag mayor undertook to regulate the use of the shore and the adjacent waters by having the city pass a ordinance which prohibited construction o boathouses and other structures. Plaintiff brough action for relief from this ordinance, alleging tha such action was an arbitrary exercise of the defen dant's power in denial of plaintiff's riparian rights On appeal from a verdict for defendant, the cour held that a riparian owner's rights are qualified restricted and subordinate to the paramount right of the public. The exercise of the state's public rights does not deprive the riparian owner of any right, but merely regulates and limits the exercise of existing rights. The state's soverign right to regu late may lawfully be delegated to a municipal cor poration. Thus all regulation by defendant wa found to be a lawful exercise of the village governmental power. (Barnett-Florida)
W70-10002

STATE EX REL PRIEGEL V NORTHERN STATES POWER CO (ENJOINING DAM OPERATION AS A PUBLIC NUISANCE).
242 Wis 345, 8 NW2d 350-354 (1943).

Descriptors: *Wisconsin, *Dams, *Power head, *Fishkill, Fish management, State governments, Rivers, Diversion, Canals, Tailwater, Floodgates, Fishing, Streams, Administration, Administrative agencies, Navigable waters, Judicial decisions, Legal aspects, Legislation, Riparian rights, Natural flow, Powerplants, Impounded waters, Regulation, Public rights.
Identifiers: *Injunctions (Prohibitory).

Water from a river was diverted by defendant's dam through its power house. The water was then discharged into a storage pond. In time of flood, defendant opened the floodgates of its dam to allow excessive water to flow into the original river bed. When the gates were closed, fish were occasionally trapped in pools below the dam and were taken illegally or died from exposure. Plaintiff game warden brought action to enjoin the dam's operation as a public nuisance, alleging that the river was navigable, that the public had a right to fish and navigate thereon, and that said dam cut off the public rights in the river and restricted the flow of water in violation of state statute. Defendant answered that the Public Service Commission had conducted a hearing and had determined that the fish loss was insignificant in light of the cost of eliminating the loss. The court found that the state statute regulating the flow of water in the case of dams in navigable streams did not apply where the water was discharged directly into a storage pond. The loss of fish caused by the operation of the dam and the de minimis diversion was insignificant and could not justify the arbitrary enjoining of such operation and diversion as a nuisance. (Barnett-Florida)
W70-10003

OFFMASTER V TAGGART (PUBLIC RIGHT O FISH IN NAVIGABLE WATERS).

06 Mich 432, 11 NW2d 193-197 (1943).

escriptors: *Michigan, *Navigable rivers, *Fish-g, *Public rights, Fish conservation, Fish ocking, Dams, Trout, Judicial decisions, Legal pects, Meanders, Streams, Riparian rights, eneficial use, Riarian land, Ownership of beds, elative rights, Recreation, State governments, avigable waters, Real property, Proprietary wer, Land tenure.

efendants claimed that a stream that crossed their nd was non-navigable and thus not open to public shing. They excavated the channel of the stream here it entered and left their property for the pur-se of making it impossible for fishermen to enter y wading. Plaintiff brought action as a private itizen alleging that the stream was navigable and, eing navigable, was subject to the public's right to ake fish therefrom. Defendant contended that they ad done nothing to impede navigation and that in ny event they had the right to prevent trespasses n their property. The Supreme Court of Michigan, eversing the lower court, held that a stream which ould not be used for boating but had been used for oating logs, and in which the public had been fish-ng for 50 years and on which the state had ex-ended large sums of money to stock it with fish as a navigable stream, and riparian owners could ot exclude the public from fishing therein. (Bar-ett-Florida)
W70-10004

GABLEMAN V DEPARTMENT OF CONSERV. (CONSTRUCTION OF STATE PARK AS VIOLA-TION OF RESTRICTIVE COVENANT ON LAKEFRONT PROPERTY).
309 Mich 416, 15 NW2d 689-691 (1944).

Descriptors: *Michigan, *Lakes, *Land use, *Fish-ng, Leases, Eminent domain, Shores, Riparian rights, Judicial decisions, Legal aspects, Conserva-tion, Administrative agencies, Regulation, Boats, Roads, Landfills, Scenery, Natural resources, Public benefits, Boat-launching ramps, Relative rights, Real property, Land tenure, Land classifica-tion, Parks.
Identifiers: *Injunction (Prohibitory), *Nuisance.

Plaintiff was the owner of lakefront property in a subdivision which was subject to restrictive cove-nants. Defendant, pursuant to its policy of making the waters of the state available to the public, purchased four lots adjacent to plaintiff's property to be used as a small state park for the launching of fishing boats. Plaintiff complained that a fishing site was contrary to the restrictions upon the use of the property and to the general plan in existence in the subdivision. The lower court found the subdivision to be strictly residential and enjoined defendant's acts as a violation of the restriction on the use of the land. The appellate court found, upon examina-tion of the record, that the land was not strictly re-sidential in that a boat livery had been in existence in non-conformity with the residential plan. Since the plan had not been rigidly followed, defendant was not bound to it. Defendant's acts in establish-ing a public fishing site were proper and did not constitute a nuisance which could be enjoined. (Barnett-Florida)
W70-10005

BOARD OF TRUSTEES V BOARD OF SUPR'VSRS (COMPULSORY CONTRIBUTION BY DRAINAGE DISTRICTS FOR MAIN-TENANCE OF COMMON FACILITIES).

19 NW2d 196-201 (Iowa 1945).

Descriptors: *Cost sharing, *Drainage districts, *Drainage systems, *Iowa, Administrative agencies, Administration, Judicial decisions, Legal aspects, Administrative decisions, Costs, Public benefits, Assessments, Ditches, Outlets, Laterals, Equalizing reservoirs, Rivers, Missouri River, Drains, Dikes, Regulation, Operation and maintenance, Financing, Cost allocation.

Plaintiff drainage district's main ditch extended north and south approximately 21 miles. Defendant districts was situated north of plaintiff. Plaintiff contended said districts were outleting their drainage into its main ditch. Plaintiff had certain repairs and maintenance operations performed in its district which were necessary to carry off the combined waters of the various districts. Plaintiff brought suit to compel the upper districts to levy assessments to pay their share of the expense of maintaining the alleged common outlet. Defendants contended that their districts did not outlet into plaintiff's ditch, but rather that they discharged their drainage into nearby natural streams. The lower court held for plaintiff, finding that defendants did in fact outlet into plaintiff's ditch. The Supreme Court of Iowa affirmed, stating that defendants' natural stream outlets did not furnish satisfactory outlets. Moreover, it held that since plaintiff's ditch provided defendants with a deeper and more adequate outlet to discharge their drainage water into, defendants could be compelled to make assessments for the maintenance thereof. (Barnett-Florida)
W70-10006

HICKS V ANDERSON (LANDOWNER'S RIGHT TO HAVE PROPERTY CONDEMNED AFTER DAMAGE RESULTS FROM STATE ACTION).
182 Va 195, 28 SE2d 629-630 (1944).

Descriptors: *Virginia, *Condemnation, *Flood-ing, *Administrative agencies, Judicial decisions, Flow, Administration, Legal aspects, Governments, State governments, Eminent domain, Surface run-off, Highways, Roads, Highway relocation, Road construction, Culverts, Surface drainage, Rain, Erosion, Arable land, Land, Damages, Flood damage, Rain water, Remedies.

Plaintiff landowner sought a writ of mandamus to compel defendant State Highway Commissioner to institute condemnation proceedings on plaintiff's property which was injured by floodwaters. Plain-tiff contended that the damage resulted from con-struction of a state road which diverted water onto his land. Defendant contended that the damage resulted from the natural flow of surface water over plaintiff's property. The Supreme Court of Appeals of Virginia held for plaintiff and issued the writ. One of whose property is damaged as a result of highway construction may not sue the common-wealth; his only remedy is through condemnation. A landowner is entitled to compensation for pro-perty damage resulting from flowage diverted onto his land by a public highway. (Dye-Florida)
W70-10007

ADAMS V CAREY (DAMAGE TO OYSTER BEDS CAUSED BY FERRYBOAT RUNNING AGROUND).
190 A 815-822 (Md 1937).

Descriptors: *Maryland, *Boats, *Oysters, *Damages, Beds, Navigation, Fog, Channels, Har-bors, Navigable waters, Ships, Ownership of beds, Beds under water, Riparian rights, Permits, Legal aspects, Judicial decisions, Relative rights, Remedies, Commercial shellfish, Shellfish, Mol-lusks.

In a fog defendant's ferryboat ran aground on a shoal and, in an attempt to free itself, damaged plaintiff's oyster beds. The appellate court felt that there was no negligence in attempting to navigate the vessel during the fog, as the ferryboat had a responsibility to get its passengers across the chan-nel regardless of the weather. However, the jury had found that the ferryboat operator did not use reasonable care in his efforts to free the boat from the shoal, which efforts damaged the beds and covered many oysters with sand, and the court declined to disturb this finding. The lower court decision was reversed, however, because of the lower court's failure to give instructions on the ef-fect of defendant's paramount right of navigation, and failure to require the jury to find whether de-fendant knew or should have known that his ac-tions in freeing the boat would damage the beds. Plaintiff's property rights in the oyster bed were held to be subject to ordinary dangers incident to navigation. Therefore, the fact that the beds were damaged by defendant's ferryboat did not of itself give rise to damages. (Caldwell-Florida)
W70-10008

CONWAY V NEW HAMPSHIRE WATER RES BD (CONSTITUTIONALITY OF LEGISLATION SETTING UP A WATER RESOURCE DEVELOPMENT PROGRAM).
199 A 83-90 (NH 1938).

Descriptors: *New Hampshire, *Legislation, *Ad-ministrative agencies, *Water resources develop-ment, Project purposes, Public benefits, Hydroelectric power, Flood control, Water storage, Project benefits, Governments, Taxes, Legal aspects, Remedies, Judicial decisions, Water utilization, Hydroelectric project licensing, Costs, Multiple-purpose projects.
Identifiers: *Constitutionality.

Petitioners brought a taxpayers' suit to enjoin ex-penditure of state funds for a water resource development program. Petitioners claimed that the legislation setting up the program was unconstitu-tional in that the projects were not for a public pur-pose. The court rejected the claim, holding that the program did involve a public purpose. Develop-ment of hydroelectric power and flood control were specifically pointed to as examples of benefits accruing to the public. The court held that the planned private use of the power, developed from storing water and employed in producing electric energy, was not a forbidden aid to private industry because the private benefits were merely incidental to the public purposes involved. No elements of a commercial enterprise were found in the program, and sufficient standards were laid down by the statute to guide the defendant board in the imple-mentation of the program. (Caldwell-Florida)
W70-10009

MAYOR AND CITY COUNCIL OF HAVRE DE GRACE V MAXA (CITY'S LIABILITY FOR DAMAGES TO RIPARIAN OWNER CAUSED BY NEGLIGENT CONSTRUCTION OF RETAINING WALL).

9 A2d 235-243 (Md 1939).

Descriptors: *Maryland, *Excavation, *Retaining walls, *Riparian rights, Bays, Judicial decisions, Legal aspects, Local governments, Cities, Riparian land, Riparian waters, Water rights, Bulkheads, Concrete piles, Landfills, Land forming, Marinas, Easements, Access routes, Compensation, Value, Real property, Property values, Project planning, Planning.

Plaintiff riparian owner brought action against de-fendant city to recover damages for injuries sustained when dredged material deposited behind a retaining wall erected by the city in constructing a yacht basin escaped and became deposited along the shore adjoining plaintiff's property, thereby depriving plaintiff of his access to the bay. Plain-tiff's evidence showed that the retaining wall was obviously insufficient and that defendant had been warned by its employees that damages to riparian owners were probable. Plaintiff contended that such evidence established defendant's negligence and liability. Defendant contended that it was not liable for the negligence of its subcontractors and that it was immune to liability since it was a mu-nicipal corporation engaged in a governmental function. Affirming a judgment for plaintiff, the court held that the subcontractor was only bound to perform according to his contract whereas de-fendant had a duty to plan the project so that ripari-an owners would be protected. The court further

held that governmental immunity did not apply to defendant where there was evidence of specific negligent acts. The court also noted that the proper measure of damages was the difference between fair market value before and after the injury, including any damage to plaintiff's personal enjoyment and use of the property. (Liptak-Florida)
W70-10010

UNITED STATES V 2.02 ACRES OF LAND (CONDEMNATION OF WATERFRONT PROPERTY).
51 F Supp 56-61 (SD NY 1943).

Descriptors: *New York, *Land tenure, *Condemnation value, *Eminent domain, Condemnation, United States, Governments, Landfills, Public lands, Cities, Parks, Land use, Military reservations, Military aspects, Grants, Judicial decisions, Legal aspects, Sea walls, State governments, Local governments, Federal government, Compensation.

In a condemnation proceeding the United States sought valuation of certain waterfront lands owned by a city and a county. The state of New York sought to take part in the award on the grounds that the original grant whereby the underwater land was conveyed contained a reverter provision which would become operative if the land were not filled and used for public park purposes. New York claimed that the taking suspended the public use and that title thereby reverted to the state. The United States District Court for the Southern District of New York ruled that the conditions of the grants were not violated when the federal government first leased and then later condemned the lands. Title was held to be in the city and county and the full award was given to them alone. (Barker-Florida)
W70-10011

WILLIS V UNITED STATES (COMPENSATION FOR FLOODING OF RIPARIAN LAND CAUSED BY FEDERAL DAM CONSTRUCTION).
50 F Supp 99-102 (SD W Va 1943).

Descriptors: *United States, *West Virginia, *Dam construction, *Eminent domain, Dams, Damsites, Damages, Flooding, Reservoirs, Navigable rivers, High-water mark, Riparian land, Erosion, Riparian rights, Banks, Boundaries (Property), Water level fluctuations, Compensation, Economic impact, Value, Governments, Remedies, Judicial decisions, Legal aspects, Legislation.
Identifiers: *Tucker Act, *Cribbing.

Plaintiff riparian landowner sought to recover for lands flooded as a result of defendant United States' construction of a dam below his property. Plaintiff contended that the dam construction had raised the water level of the river abutting his property above the ordinary high-water mark and that recovery was authorized by the Tucker Act. Plaintiff further claimed damage to cribbing placed at the old river edge to prevent erosion. The United States claimed that the reservoir level was not above the ordinary high-water mark and that the cribbing had become useless and thus had no value. The United States District Court, Southern District of West Virginia, ruled that the government had raised the water level above the ordinary high-water mark thus flooding plaintiff's land, and that the inundated cribbing was functional. An award for the flooded land taken and the damage to the cribbing was granted to the plaintiff. (Barker-Florida)
W70-10012

GRANT V TENNESSEE VALLEY AUTHORITY (IMMUNITY OF GOVERNMENTAL AGENCY FROM SUIT).

49 F Supp 564-567 (ED Tenn 1942).

Descriptors: *Tennessee, *United States, *Tennessee Valley Authority Project, *Damages, Navigation, Navigable rivers, Tennessee River, Dams, Damsites, Multiple-purpose projects, Project planning, Legislation, Governments, Hydroelectric power, Hydroelectric plants, Project purposes, Flooding, Crops, Benefits, Remedies, Judicial decisions, Legal aspects, Political aspects, Direct benefits, Project benefits.
Identifiers: *Immunity (Governments).

Plaintiff landowner sued the Tennessee Valley Authority for alleged negligence in its operations, by which plaintiff's crops were damaged. Defendant, in a motion for summary judgment for failure to present justiciable facts, claimed immunity from the suit. The United States District Court for the Eastern District of Tennessee ruled that if damage did occur to plaintiff, it stemmed from the government's power over navigation, and that the government is only answerable in damages when it engages in activities as a private citizen. The court further held that defendant was merely an agent of the federal government and thus enjoyed the same immunity from suit. The motion for summary judgment was granted. As dicta, the court noted that plaintiff had actually been benefited by defendant's operations, since without the project's existence, the flood damage would have been greater than it was. (Barker-Florida)
W70-10013

RICHARD V KAUFMAN (DAMAGE TO SPRING CAUSED BY BLASTING OPERATIONS).

47 F Supp 337-339 (Ed Penn 1942).

Descriptors: *Pennsylvania, *Explosions, *Adjudication procedure, *Springs, Explosives, Damages, Spring waters, Subsurface waters, Water sources, Excavation, Hazards, Deformation, Remedies, Judicial decisions, Legal aspects, Tunnel construction, Tunneling, Tunnels.

Plaintiff landowner brought an action to recover for damage to a spring allegedly caused by defendant's tunneling and blasting operations on adjacent property. Defendant construction company argued that the blasting was not the direct cause of the damage to the spring. The trial jury ruled in favor of plaintiff and the U. S. District Court for the Eastern District of Pennsylvania, affirmed, holding that the question as to whether the blasting operations caused the damage to the spring was properly submitted to the jury for determination. Moreover, testimony by two witnesses concerning the flow of the spring was properly admitted. (Barker-Florida)
W70-10014

MUTUAL CHEMICAL CO OF AMERICA V MAYOR AND CITY COUNCIL OF BALTIMORE (RELATIVE BULKHEAD--FILL RIGHTS).
33 F Supp 881-891 (D Md 1940).

Descriptors: *Maryland, *Cities, *Bulkhead line, *Relative rights, Riparian rights, Navigation, Piers, Landfills, Land forming, Airports, Runways, Administrative agencies, United States, Governments, Permits, Regulation, Planning, Banks, Riparian land, Ownership of beds, Remedies, Judicial decisions, Legal aspects, Land tenure, Contracts.

Plaintiff landowners brought suit to have the extent of their riparian ownership along a river established and to enjoin the City of Baltimore from encroaching on those rights. The bulkhead and pier lines in the river had been established by the United States government. The city sought and was granted a permit to fill to those lines in order to build an airport, and an agreement between the city and surrounding landowners was established whereby the relative riparian rights concerning the bulkhead lines were agreed upon. When the city later sought to expand the airport, a new plan, which expanded the city's rights, was proposed to the landowners. Plaintiff's who had acted substantially in reliance on the old plan, brought suit. The United States District Court of Maryland ruled that where the city had adopted a plan for apportioning the harbor line to owners of an irregular shore, a such plan fixed the city's riparian rights, the could not thereafter adopt a new plan giving its additional riparian rights and curtailing the ripari rights of the other shore owners. The injunct was granted. (Barker-Florida)
W70-10015

GOODMAN V UNITED STATES (DAMA FROM GOVERNMENT'S NAVIGATION PR JECT).
28 F Supp 497-504 (S D Iowa 1939).

Descriptors: *Iowa, *Missouri River, *Flo damage, *Eminent domain, United States, Gover ments, Navigable rivers, Navigation, Projects, Pr ject purposes, Water policy, Damages, Floodir Structures, Piles (Foundations), Diversion stru tures, Sedimentation, Sediment control, Legis tion, Remedies, Crops, Riparian rights, Judic decisions, Legal aspects, High-water mark.
Identifiers: *Revetments, *Tucker Act.

Plaintiff riparian landowner on the Missouri Riv brought action to recover damages stemming fro a United States government project to impro navigation on the River. The United States ha erected pile dikes and revetments in the River an the resulting higher water level flooded plaintiff land destroying his crops. Plaintiff alleged suc damage was a taking under the fifth amendme and sought recovery under the Tucker Act for case not sounding in tort. The United States Di trict Court for the Southern District of Iowa rule that, in such an action, recovery can be given on where the government contemplated damag would result from its activity and an implied co tract can be found. The court further held tha plaintiff's damages were consequential and temp rary, thus removing the case from the purview the Tucker Act and making the United States im mune from the suit. (Barker-Florida)
W70-10016

HUMBOLDT LOVELOCK IRR LIGHT AN POWER CO V SMITH (STATE REGULATIO OF RIVER WATER DIVERSION).

25 F Supp 571-575 (D Nev 1938).

Descriptors: *Nevada, *Adjudication procedure *Prior appropriation, *Administrative decisions Appropriation, Preferences (Water rights), Priori ties, Water rights, Administrative agencies, State governments, Legal aspects, Judicial decisions Reservoirs, Irrigation water, Hydroelectric power Livestock, Water demand, Regulation, Intake gates, Diversion, Arid climates, Distribution, Su pervisory control (Power).

Plaintiff corporation owned a reservoir constructed for the purpose of impounding surplus and unappropriated waters of the Humboldt River. Subsequent to impoundment the waters were used by the corporation's stockholders for irrigation, livestock and power purposes. Pursuant to his statutorily granted authority to regulate diversions from the Humboldt River, defendant state engineer closed the intake gates to plaintiff's reservoir system. Plaintiff sued, contending that the statutory procedures for such closing denied it due process. The United States District Court dismissed the case, holding that the statute in question did provide such full opportunity to be heard as would satisfy due process requirements. Moreover, the court noted that arid and semi-arid states, in the exercise of their police power, may regulate the manner of appropriation and distribution of water from natural streams for purposes of irrigation. (Marsee-Florida)
W70-10017

ADAMS-MCGILL CO V HENDRIX (OWNERSHIP OF SPRING).
22 F Supp 789-792 (D Nev 1938).

scriptors: *Nevada, *Springs, *Land tenure, Water rights, Boundaries (Property), Relative hts, Legislation, Surveys, Water utilization, Con-cts, Legal aspects, Grazing, Real property, aims (Contracts).

pon default by defendant purchaser on a land ntract, plaintiff vendor brought an action to cover the purchase price. The purchaser de-nded by alleging that a certain spring, the rights which were included in the contract, were not ned and could not be delivered by plaintiff. The urt held that, in light of the great value of spring hts in an arid land and the fact that the rights re protected by statute, such rights could be con-ered as real property. However, the contract tween plaintiff and defendant contained no war-nty clause, and the court found that the plaintiff d only contracted to deliver such rights to the ring as he possessed, which were none. Plaintiff as held to be entitled to recover. (Caldwell-orida)
70-10018

ENNESSEE ELECTRIC POWER CO V TVA ALIDITY OF FEDERAL PROJECTS UNDER HE TVA ACT OF 1933).
F Supp 947-961 (ED Tenn 1938).

escriptors: *Tennessee Valley Authority Project, Dam construction, *Public utilities, *Hydroelec-ic plants, Hydroelectric power, Remedies, egislation, Flood control, Project purposes, Legal spects, River basin development, Dams, Compet-g uses, Judicial decisions, Administrative agen-es, Federal government, Cities, Electric power roduction, Damages, Navigation, State govern-ents, Water storage, Multiple-purpose projects.
dentifiers: *Constitutionality.

laintiffs, private electric power companies, sought o enjoin construction and operation of any TVA ydroelectric project. Plaintiffs in essence claimed hat the TVA Act of 1933 and the acts performed y the Authority were unconstitutional. In the ourse of a comprehensive discussion of the ackground of the TVA program, the Federal Dis-rict Court found that the purposes of the dams in uestion were electric power production, flood ontrol, and National Defense. The Act was held onstitutional under the national defense clause of he Constitution and under the power of Congress o control navigation under the Commerce clause. No conspiracy, coercion, or unlawful competition, as alleged by plaintiffs, were found to exist. Both he existing and planned operations of the dams were found to be in compliance with the statute. The court held that since the United States had acquired the sites and constructed the dams legally, the energy produced therefrom was property be-longing to the United States. This property could be legally sold just as any other government proper-ty. The complaint was therefore dismissed. (Cald-well-Florida)
W70-10019

UNITED STATES V POWER COUNTY, IDAHO (ATTEMPT BY COUNTY TO TAX UNITED STATES PROPERTY).

21 F Supp 684-688 (D Idaho 1937).

Descriptors: *Taxes, *Land tenure, *United States, *Idaho, Condemnation, Reservoirs, Assessments, Water storage, Federal government, Legal aspects, Federal reservations, Judicial decisions, Real property, Local government, Cities, Flooding.

When it appeared that a small town in Idaho was to be inundated by a new federal reservoir, the United States acquired, by purchase and condemnation, nearby land on which to construct a new town. Subsequently, the county sought to tax the equitable interest in the land of the local American Falls Reservoir District. The United States protested the assessment, as it still held legal title to the property. The court held that title had vested in the United States upon acquisition of the land, and could not be divested except by Congressional action. The land therefore belonged to the United States and was immune from local taxation. (Caldwell-Florida)
W70-10020

HAGIE V LINCOLN LAND CO (CHARGE OF POINT OF DIVERSION FROM STREAM CLAIMED TO BE ABANDONMENT OF RIGHT TO DIVERT).
18 F Supp 637-641 (D Wyo 1937).

Descriptors: *Water rights, *Prior appropriation, *Wyoming, *Diversion, Priorities, Streams, Ditches, Alteration of flow, Dams, Water utilization, Irrigation, Competing uses, Relative rights, Legislation, Beneficial use, Water supply, Consumptive use, Preferences (Waterrights), Irrigation water, Groundwater movement, Percolation, Land use, Legal aspects, Adjudication procedure.

Defendant had previously established an appropriative right to divert water from the main channel of a stream. When defendant closed his original point of diversion and built a dam farther downstream on his property for irrigation purposes, plaintiff, a downstream landowner, claimed abandonment of defendants' right to divert. The court in holding for the defendant found that plaintiff could not maintain his suit because he could not show that he would be benefitted by a declaration of abandonment. Other intervening riparian owners had unfulfilled priorities which would more than take over any water which defendant would forfeit. The court further found that, even though the original diversion point had been closed, there had been no abandonment. Defendant had built a dam downstream, which caused water to percolate onto his fields, an unusual but effective means of irrigation. The complaint was therefore dismissed. (Caldwell-Florida)
W70-10021

HOLYOKE WATER POWER CO V AMERICAN WRITING PAPER CO (CONTRACT PROHIBITING POWER TRANSMISSION FROM LAND GRANTED).
17 F Supp 895-899 (D Mass 1936).

Descriptors: *Hydroelectric power, *Dams, *Contracts, *Canals, Mills, Water contracts, Electric power, Hydroelectric plants, Transmission (Electrical), Electric power production, Water utilization, Mill dams, Land tenure.

Complainant sought to enjoin respondent from transmitting elsewhere electric power produced on respondent's millsite. Complainant had granted respondent's predecessors in interest the millsite and the right to a certain amount of water power. A clause in the contract provided that the power produced on the millsite was to be used only on the land on which the mill was located, and complainant contended that this clause prohibited transmission of electric power generated on the site to other locations. The court rejected this contention. While stating that electricity was essentially an improved means for the transfer of power and not a separate commodity, the court held that the original limitation had only the purpose of assuring complainant a specified place to deliver the water, and did not prevent respondents from transmitting electric power. (Caldwell-Florida)
W70-10022

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, BRAZOS AND BOSQUE RIVERS, WACO, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W70-09536

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
William Hines, J. W. Howe, and Dick Montgomery.
Land and Water Law Review, Vol. 5, p 321-350 (1970). 30 p, 66 ref, 1 append.

Descriptors: *Flood plain zoning, *Legislation, *Flood protection, *Land use, Regulation, Flood control, Flood damage, Flood plains, Rivers, Governments, Public benefits, Legal aspects, Political aspects, Economics, Obstruction to flow, Local governments, Zoning, Project purposes, Floodways, Planning, Data collections, Rational formula, Land classification, Building codes, Structures.

Despite the construction of extensive flood protection devices, annual flood losses have continued to rise. The author contends that flood plain regulations directed toward control of property and structures within flood plains are necessary to reduce flood damage. Such measures would be constitutional as necessary for the public welfare even though they restrict the use of property within the affected area. The model statute suggested by the author would classify the flood plain into three districts: floodways, flood plain districts, and upland districts. Floodways, the river channel and the area immediately adjoining the channel, would be subject to restrictions preventing any use which would obstruct the efficient carrying away of flood waters. The other two districts would be subject to respectively less stringent ristrictions. The delineation of district boundaries, based on the maximum probable flood, may be very difficult, and local authorities should avail themselves of data available from state and federal agencies. (Caldwell-Florida)
W70-09785

FLOOD PLAIN INFORMATION, PARKER CREEK, MARSHALL, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W70-09845

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, ORANGE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W70-09846

6G. Ecologic Impact of Water Development

POSSIBILITIES FOR BENEFICIAL USES OF HEATED WATER DISCHARGES INTO COOLING RESERVOIRS,
Missouri Univ., Columbia. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-09596

ECOLOGY-ITS PLACE IN WATER MANAGEMENT,
Michigan Univ., Ann Arbor. School of Natural Resources.
Stanley A. Cain.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, Summer 1969, p 10-14. 1 photo.

Descriptors: *Ecology, *Environment, *Water management, Water resources, Natural resources, Environmental effects, Watershed management, Sequence.
Identifiers: *Interrelations, *Sequences of change.

The author discusses ecology and its place in the management of natural resources, specifically water resources. The ecological approach is concerned with interrelations among living things and their environment, sequences of change in an environment, and interconnections between one environmental site and another. This approach differs from the traditional cause-and-effect approach

which views elements separately. These ideas are related to water resources management with the stream seen as a creature of the watershed, the entire land surface that provides water drainage into the stream. A change in any part of the watershed may affect a sequence of interrelated changes in the rest of the watershed. Some examples are given where the ecological approach was not used and effects have been detrimental to man's ecology which, in effect, encompasses all ecology. Greater application of ecological foresight to management of water and other related natural resources can help us avoid disasters in the future and assure a more productive environment. (Marriott-Chicago)
W70-09645

SOME HYDROLOGIC AND BIOLOGIC ASPECTS OF THE BIG CYPRESS SWAMP DRAINAGE AREA, SOUTHERN FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 04A.
W70-09704

ESTUARINE CONSERVATION LEGISLATION IN THE UNITED STATES,
Milton S. Heath, Jr.
Land and Water Law Review, Vol. 5, p 351-390 (1970). 40 p, 61 ref. 1 append.

Descriptors: *Conservation, *Legislation, *Estuarine environment, *Estuaries, Ecology, Wetlands, Water pollution, Aquatic habitats, Coasts, Preservation, Permits, Regulation, Marshes, Administrative agencies, Legal aspects, Judicial decisions, State jurisdiction, Programs, Dredging, Natural resources, Marsh management, Adoption of practices, Adjudication procedure, Florida, California.

Estuarine areas are being threatened by pollution and by physical alterations by man that reduce acreage of estuarine marshes and open waters. Presently, the only federal regulation of activities affecting these areas is the system of permits administered by the Army for projects affecting navigable waters. Several coastal states have legislative programs regulating dredging or filling, establishing bulkhead lines, and setting up zoning criteria. Some states also have provisions for acquiring estuarine areas for public use. Court decisions concerning the validity of state legislation restricting the use of estuarine property have been split. The author examines several state programs for estuarine conservation, including California and Florida. In addition to the provisions listed above, these legislative frameworks include fish and game regulation and use permits. The author presents a suggested state law for control of estuarine areas. This statute would include a broad permit system for any use of these areas and would provide for a comprehensive study of estuarine environment problems. (Caldwell-Florida)
W70-09786

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
For primary bibliographic entry see Field 06E.
W70-09789

TODAY THE ENVIRONMENT, TOMORROW THE WORLD,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries.
Frederick E. Smith.
Bioscience, Vol 19, No 4, p 317-320, April 1969.

Descriptors: *Ecosystems, *Nutrient requirements, *Transpiration, Soil-water-plant relationships, *Productivity, Ecology, Arid lands, Tropical regions, Grasslands, Forests, Agriculture, Biomass, Aquatic plants, Aquatic productivity, Energy transfer, Erosion, Streamflow.
Identifiers: *Population ecology, *Temperate zones, *Protein production, *Calorie production, *Ecosystem alteration, Nutrient status.

Since we are accelerating ecosystem exploitations, we must recognize their limitations as well as potentialities. Predation increases protein production while plant consumption increases calorie production. An increase in the production of one leads to a decrease in the other. Since world protein deficiency is currently greater than calorie deficiency, grasslands should not be replaced by crops because this leads to a decline in animal protein production. Similar problems exist between water quality and water quantity. Forest ecosystems transpire high quality water and their destruction leads to greater runoff, but of lower quality water. In terrestrial plants 95-99 percent of all utilized solar radiation supports nutrient transport via the mechanism of transpiration. Arid lands suffer least in this respect because soil nutrients are more evenly dispersed with the consequence of many irrigation projects in these areas. However, all such irrigation projects have ultimately failed due to soil salt accumulation. In humid tropical areas, nutrients lie on the surface in low concentrations with consequent high transpiration rates. Agricultural potential is limited because the nutrients soon wash away after destruction of native vegetation. Man's most successful ecological alterations have been the conversions of forests to grasslands. (Casey-Arizona)
W70-09953

PRECIPITATION MODIFICATION IN SEMIARID AND ARID REGIONS,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09959

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09960

07. RESOURCES DATA

7A. Network Design

POTOMAC RIVER WATER QUALITY NETWORK, COMPILATION OF DATA-WATER YEAR 1969.
Interstate Commission on the Potomac River Basin, Washington, D.C.
For primary bibliographic entry see Field 05A.
W70-09557

THE CONTROL OF RIVER HEATING BY ACCURATE DIGITAL SIMULATION,
Motor-Columbus Engineering Co., Baden (Switzerland).
For primary bibliographic entry see Field 05G.
W70-09594

PRINCIPLES FOR DISTRIBUTION AND PROSPECTS FOR DEVELOPMENT OF A HYDROLOGIC NETWORK,
I. F. Karasev.
Trans. from Trudy Gossuder. Gidrolog. Instituta, No. 164, 1968. Soviet Hydrology: Selected Papers, Issue No 6, 1968, p 560-588. 29 p, 3 fig, 2 tab, 23 ref.

Descriptors: *Hydrologic aspects, *Rivers, *Lakes, *Reservoirs, *Optimization, Runnoff, Water balance, *Distribution patterns.
Identifiers: Base stations (Posts), Water regime.

A network of hydrologic posts was used to study the regime of land waters and to obtain regularly information on processes in bodies of water. The hydrologic network included (1) base stations (posts) for systematically observing the hydrologic regime of rivers, lakes and reservoirs; (2) special stations (posts) for studying the local characteristics of the water regime, conditions of form tion of runoff and elements of the water balan (3) various kinds of networks and (4) expedition ry (temporary) posts designed for detailed study hydrologic processes. The special network was ranged and operated in accordance with resear programs. Examination of the principles for d tribution of the basic networks was the main obj tive. The information received from the netwo included data on water levels, discharges and se ment, water temperature and ice phenomena. T optimum structure of the observation system w governed by tests of economic efficiency in t branches of the national economy using hydrolo data. (See also W-6908734) (Kriss-Cornell)
W70-09828

PROGRAM OF THE WATER RESOURCE DIVISION, TEXAS DISTRICT FOR THE 19 FISCAL YEAR AND SUMMARY OF DISTRIC ACTIVITIES DURING FISCAL YEAR 1969.
Geological Survey, Austin, Tex. Water Resourc Div.
For primary bibliographic entry see Field 09D.
W70-09836

7B. Data Acquisition

DELINEATION OF LINEAR FEATURES AN APPLICATION TO RESERVOIR ENGINEE ING USING APOLLO 9 MULTISPECTRA PHOTOGRAPHY,
Geological Survey, University, Ala.
W. J. Powell, C. W. Copeland, and J. A. Drahovza
Alabama Geological Survey Information Series 4 1970. 37 p, 13 fig, 3 tab, 6 ref.

Descriptors: *Remote sensing, *Water resource *Infrared radiation, *Structural geolog Hydrogeology, Groundwater, Streamflow, Lo flow, Springs, Water wells, Water yield, Fault (Geology), Alabama, Appalachian Mountain Re gion.
Identifiers: *Lineations, *Multispectral photog raphy, Apollo 9.

Four multispectral photographs of east centra Alabama were made by the crew of the Apollo spacecraft. The photographs cover a 6,400 squar mile area (about 80 x 80 miles square) betwee Birmingham, Alabama, and the Georgia State boundary. The most significant features observe on the photographs are the relatively straight lon lineations that intersect Appalachian structura axes. Because little or no offset in topographic fea tures is evident along most of the traces, the linea tions are thought to represent fractures. Apparen coincidence of the linear features with areas o known anomalies of streamflow, of large capacity wells and springs, quarry drainage, and dam leakage problems indicate that lineations may have not only a marked geologic effect but also may be of great hydrologic, environmental, and economic significance. The interpretations made of the photographs indicate the following applications (1) Determining areas of groundwater movement; (2) Determining areas where large quantities of groundwater are available; (3) Determining areas for making low-flow measurements; (4) Determin ing areas for locations of gaging stations; (5) Locat ing sites of optimum hydrogeologic conditions for the construction of dams and reservoirs; (6) As an aid in geologic mapping; and (7) As an aid in the study of structural geology of an area. (Knapp USGS)
W70-09537

PHYSICAL STUDIES OF NATURE BY THERMAL MAPPING,
Research Inst. of National Defense, Stockholm (Sweden); and Lund Univ. (Sweden). Dept. of Physical Geography.
E. Fagerlund, B. Kleman, L. Sellin, and H. Svensson.
Earth-Science Reviews, Vol 6, No 3, p 169-180, June, 1970. 12 p, 14 fig, 1 tab, 4 ref.

Descriptors: *Remote sensing, *Infrared radiation, Mapping, Surveys, Photometry, Terrain analysis, Instrumentation.
Identifiers: *Thermal mapping, Sweden.

Thermal mapping by airborne equipment makes it possible to trace and detect processes and properties which have their most distinct radiation characteristics in the infrared part of the spectrum. For discipline of the earth sciences, such as physical geography, geology, climatology (especially micro- and mesoclimatology) and hydrography which work by collecting and analyzing data from ground and water surfaces, thermal mapping represents a scientific tool for gathering information earlier inaccessible. (Knapp-USGS)
W70-09540

THE AIRBORNE INFRARED SCANNER AS A GEOPHYSICAL RESEARCH TOOL,
Geological Survey, Washington, D.C.
Jules D. Friedman.
Optical Spectra, Vol 4, No 6, p 35-44, June 1970. 10 p, 12 fig, 1 tab, 22 ref.

Descriptors: *Remote sensing, *Infrared radiation, Geophysics, Monitoring, Water pollution sources, Thermal pollution, Geology, Solar radiation, Heat transfer.
Identifiers: Infrared scanners.

The key role of airborne infrared line-scan imaging systems in geophysical exploration and environmental control is to record temporal and spatial variations in broadband thermal emission from the earth's surface. Correlation of these variations with convective heat flow anomalies, resistivity lows, thermal pollution, and occurrence of microearthquakes is just beginning to pay dividends in volcanology, in exploration, in pollution monitoring, and development of geothermal power sources. In planning precise airborne surveys of radiant flux from the earth's surface account must be taken of background noise created by variations in micrometeorological factors and emissivity of surface materials, as well as the diurnal temperature cycle. The effect of the diurnal cycle may be minimized by planning predawn aerial surveys. (Knapp-USGS)
W70-09541

FIELD METHODS FOR MEASUREMENT OF FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-09550

ANALYSIS OF A RECONNAISSANCE GRAVITY SURVEY FOR DRIFT-FILLED VALLEYS IN THE MERCER QUADRANGLE, PENNSYLVANIA,
Naval Oceanographic Office, Washington, D.C. Magnetics Div.; and Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02F.
W70-09686

EVALUATION OF SELECTED COBALT-60 COMPLEXES AS TRACERS OF GROUNDWATER,
Northeast Louisiana State Coll., Monroe. Dept. of Chemistry; and Agricultural Research Service, Oxford, Miss.
Frank N. Bruscato, and J. Roger McHenry.
Journal of Hydrology, Vol 10, No 4, p 406-417, June 1970. 12 p, 3 fig, 6 tab, 16 ref.

Descriptors: *Tracers, *Cobalt radioisotopes, *Groundwater movement, Ion exchange, Clay minerals, Laboratory tests, Radioisotopes, Radioactivity techniques, Translocation.
Identifiers: Complexes.

A series of Co-60 compounds, considered as potentially useful tracers of groundwater movement, were prepared and evaluated in soil column and batch studies. The compounds were: potassium hexacyanocobaltate (III), potassium ethylenediaminetetraacetato-cobaltate (III), ammonium 12-tungstodi-cobaltoate (III), chloraquotetrammine cobalt (III) chloride, and sodium hexanitrocobaltate (III),. The performance of the complexes of CN and EDTA were dependent on their environment and more especially on the type and amount of clay present. The EDTA cobalt complex cannot be used in soils that bare basic or where a large fraction of the clay is saturated with Na or Ca. Of the other radioactive tracers tested; none were suited for groundwater tracing because of instability in aqueous solution, variable anionic structure under acid conditions, or preferential uptake by the clay fraction. (Knapp-USGS)
W70-09691

AN EXACT METHOD FOR CHARACTERIZATION OF GRAIN SHAPE,
Michigan State Univ., East Lansing. Dept. of Geology; and Michigan State Univ., East Lansing. Dept. of Computer Science.
For primary bibliographic entry see Field 02J.
W70-09697

INVENTORY OF HYDROBIOLOGICAL FEATURES USING AUTOMATICALLY PROCESSED MULTISPECTRAL DATA,
Geological Survey, Miami, Fla.; and Michigan Univ., Ann Arbor.
Milton C. Kolipinski, Aaron L. Higer, Norma S. Thomson, and Frederick J. Thomson.
Proceedings of 6th International Symposium on Remote Sensing of Environment, Oct 13-16, 1969, Michigan Univ, Institute of Science and Technology, p 79-95, 1970. 17 p, 5 fig, 3 tab, 4 ref.

Descriptors: *Remote sensing, *Aerial photography, *Florida, *National Parks, *Marshes, Surveys, Computers, Digital computers, Analog computers, Data processing, Data collections, Hydrologic data, Mapping, Vegetation, Spectroscopy, Photogrammetry.
Identifiers: Everglades National Park.

Multispectral data were used to map automatically eight different landscape site units in a portion of Everglades National Park in south Florida. By using various combinations of narrow spectral bands, it was possible to differentiate and map tree islands, sawgrass grasslands, spikerush grasslands, and two different depths of water. The recognition techniques that were developed employed both digital and analog computing equipment, but the emphasis was on fast processing using analog techniques. The output of the computer was in the form of recognition maps printed in several colors and then overlayed to provide a color composite map of the ground features. Data in this form, collected periodically, can be used to determine the direction and extent of successional changes of vegetation and should provide a better basis for water management practices. The multispectral scanning techniques employed in the Everglades have transfer value to other hydrologic situations. (Knapp-USGS)
W70-09835

DETECTION OF UPWARD PERCOLATION OF SALINE LAKE WATER,
Weizmann Inst. of Science, Rehovoth (Israel); and Water Planning for Israel, Tel Aviv. Hydrological Branch.
For primary bibliographic entry see Field 02H.
W70-09838

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
E. Eriksson.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Viennna, Paper No SM-83/2, p 21-33, 1967. 13 p, 7 fig, 13 ref.

Descriptors: *Tracers, *Radioisotopes, *Stable isotopes, *Hydrologic cycle, *Meteorology, Tracking techniques, Hydrogen, Deuterium, Tritium, Oxygen, Fallout, Hydrology, Groundwater movement, Surface waters.
Identifiers: Isotope techniques.

In recent years rather comprehensive studies have been made of the occurrence and distribution in time and space of tritium, deuterium and 0-18 precipitation and atmospheric moisture. Tritium has been injected into the atmosphere, especially during hydrogen bomb tests, in enormous quantities as compared with the natural production in the atmosphere. Because of its radioactivity it can be used as a tracer in the circulation of water in nature, and can, under special circumstances reveal features of the circulation which are otherwise not easily studied. Deuterium and 0-18 in natural waters are subject to fractionation processes during their transport between the earth's surface and the atmosphere. These processes are sometimes easily interpreted and can yield valuable information on particular parts of the water circulation. However, the fractionation processes are often complicated by subsequent mixing processes in the atmosphere, which makes interpretation more difficult. (See also W70-09868) (Knapp-USGS)
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
B. Arnason, and Th. Sigurgeirsson.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Goedesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM 83/3, p 35-47, 1967. 13 p, 6 fig, 10 ref.

Descriptors: *Tracers, *Deuterium, *Tritium, *Groundwater movement, *Hot springs, Surface waters, Precipitation (Atmospheric), Thermal water, Thermal springs, Sampling, Radiochemical analysis.
Identifiers: Iceland.

The deuterium content in monthly samples of precipitation at Reykjavik, Iceland, has been measured continously for the past 8 yr. The results show considerable fluctuations for individual months and a slight annual variation. Numerous water samples from cold springs in south-west Iceland show no time variation in deuterium content, whereas samples taken from streams in the same area show a small variation. Cold springs and rivers have similar deuterium content as the total yearly precipitation in their recharge area as judged from monthly samples. Because the time variations are small, these sources are very useful indicators of the mean deuterium content in the precipitation and its variation with geographical position. A map shows how the deuterium content varies with the distance from the sea and how the distribution is modified by the landscape. Samples of steam and liquid water from some boiling boreholes show that equilibrium is achieved between deuterium concentrations in the vapor and the water phase. This makes it possible to calculate the deuterium content of the recharge water for a hot spring from deuterium measurements of the water phase alone, if the base temperature of the recharge water is known. The thermal waters do not change in deuterium content during passage underground. (See also W70-09868) (Knapp-USGS)
W70-09870

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
For primary bibliographic entry see Field 02E.
W70-09874

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
For primary bibliographic entry see Field 02J.
W70-09876

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05A.
W70-09878

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
J. R. McHenry, N. L. Coleman, J. C. Willis, C. E. Murphree, and G. C. Bolton.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No Sm-83/17, p 207-225, 1967. 19 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Sediment load, *Suspended load, *Nuclear meters, Radioactivity techniques, Stream gages, Sediment transport, Instrumentation.
Identifiers: Nuclear sediment meters, Sediment concentration gages.

Three sediment concentration gages, utilizing the attenuation of transmitted gamma rays as a measure of density, were compared in laboratory tests. Two of the gages used Cd-109 as the radioactive source and one employed Am-241. The effects of each probe on stream velocity and sediment concentration gradients within the sampling area were considered. The precision and accuracy of the laboratory measurements were calculated and calibration curves were obtained under both static and dynamic conditions. A minimum detectable sediment concentration of less than 500 ppm was obtained with the Am-241 gage developed by the IAEA laboratories. The Cd-109 gage developed for remote, unattended, automatic operation was the least sensitive to small changes in sediment concentration. In their present state of development, these nuclear-sediment concentration gages supplement rather than compete in their use and performance. Each gage will provide the hydrologist with information not now obtainable by conventional means or will provide more information at a lower expenditure than is now possible. (See also W70-09868) (Knapp-USGS)
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
For primary bibliographic entry see Field 02J.
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09881

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
For primary bibliographic entry see Field 02J.
W70-09884

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut.
For primary bibliographic entry see Field 02F.
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02F.
W70-09886

QUANTITATIVE ANALYSIS OF TOTAL CARBON DIOXIDE IN SEA WATER: A NEW EXTRACTION METHOD,
Scripps Institution of Oceanography, La Jolla, Calif.
C. S. Wong.
Deep-Sea Research, Vol 17, p 9-17, 1970. 2 fig, 11 ref.

Descriptors: *Analytical techniques, *Carbon dioxide, *Sea water, *Methodology, Infrared radiation, Sampling, Laboratory tests, Pacific Ocean, Tropic, Depth, Analysis, Calibration, Gravimetric analysis.
Identifiers: Vacuum extraction, Infrared analysis, Extraction procedure, Sodium carbonate.

Total carbon dioxide is defined as the sum of carbon dioxide concentration and all other carbon species in solution, which react with dilute acid to form carbon dioxide. Concentration of total carbon dioxide in seawater has been determined to a precision of plus or minus 0.15% standard deviation and an accuracy of about plus or minus 0.2% by a new method employing vacuum extraction and infrared analysis. This precision and estimated accuracy were achieved through accurate sampling of aliquots by a special pipette, elimination of reagent blanks, purification of carbon extracted and improvements in preparation of a gravimetric standard for calibration of the infrared analyzer. Comparison of extractions made on shipboard and extractions made subsequently in shore laboratory on preserved samples show that ocean water sterilized with 100 ppm of mercuric chloride does not change its total carbon dioxide during storage in stoppered Pyrex bottles at room temperature for a period up to 3 months. The extraction was used to obtain pure carbon dioxide for carbon-13 isotopic studies and for rain and ice. The gravimetric standard has provided for rapid calibration of infrared analyzer or for other methods such as those employing gas chromatography. (Jones-Wisconsin)
W70-09892

A SIMPLE, INEXPENSIVE ALGAL CHEMOSTAT,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Edward J. Carpenter.
Limnology and Oceanography, Vol 13, No 4, p 720-721, 1968. 1 fig, 2 ref.

Descriptors: *Analytical techniques, *Algae, Plankton, Diatoms, Marine algae, Fresh water, Flow rates, Pumps, Electrolysis, Cultures.
Identifiers: *Chemostat, Physiology, Flagellates.

A simple chemostat has been developed which does not use expensive mechanical action pumps or elaborate gravity flow systems. In addition, the entire apparatus can be easily sterilized as a unit if the rubber stoppers in the chemostat are left ajar during autoclaving. An electrolysis pump generates a gas mixture which displaces the culture medium from the medium reservoir into the algae culture vessel. The flow rate of the culture medium is regulated by a variable resistor in the circuit and indirectly monitored with a milliammeter. Mixing and aeration of algae and medium is accomplished by pumping sterile, cotton-filtered air through the culture vessel. An overflow vessel effectively prevents back contamination of the culture vessel by bacteria as a suspension of the organisms under culture continually flows out. The volume of medium within the culture vessel is regulated through siphon action by adjusting the height of the overflow tube. This chemostat has been used successfully in several nutrient limited, axenic experiments on two planktonic marine diatoms and one fresh water flagellate. (Jones-Wisconsin)
W70-09904

7C. Evaluation, Processing and Publication

SCALE EFFECTS IN THE PHYSICAL MODELING OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-09538

DERIVING THE UNITGRAPH WITHOUT USING RAINFALL DATA,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02E.
W70-09680

ANALYSIS OF DATA FROM PUMPING TESTS IN UNCONFINED ANISOTROPIC AQUIFERS,
For primary bibliographic entry see Field 02F.
W70-09681

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 02A.
W70-09831

INVENTORY OF HYDROBIOLOGICAL FEATURES USING AUTOMATICALLY PROCESSED MULTISPECTRAL DATA,
Geological Survey, Miami, Fla.; and Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 07B.
W70-09835

MARKOV CHAINS AND EMBEDDED MARKOV CHAINS IN GEOLOGY,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 06A.
W70-09848

APPLICATION OF NUMERICAL CALCULATIONS TO THE STUDY OF WAVES AND SHORE INTERACTIONS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 02L.
W70-09854

08. ENGINEERING WORKS

8A. Structures

URBAN STORM DRAINAGE CRITERIA MANUAL FROM DENVER,
Wright-McLaughlin Engineers, Denver, Colo.

lmer L. Claycomb.
ivil Engineering, Vol 40, No 7, p 39-41, July 970. 3 p, 1 fig, 2 tab.

escriptors: *Storm drains, *Design, *Drainage ystems, Cities, Urbanization, Sewers, Storm ru- off, Rational formula, Hydrograph analysis, Rain- all-runoff relationships.
dentifiers: *Denver (Colo), *Storm drain design anual.

storm drainage criteria manual developed by the enver Regional Council of Governments to pro- ide uniform guidelines and technical design infor- ation for those involved with storm water rainage is reviewed. The overall approach taken is ased on two separate drainage systems: the initial, r convenience, system for regularly occuring flows return frequency of once in 2 to 10 years), and the ajor system for relatively infrequent flows. The esign of streets receives extensive coverage, with llowable drainage capacity related to traffic olume. Storm sewer design is based entirely on ydraulics, replacing rule-of-thumb procedures for ead loss at manholes. Hydrological design is based n a modified rational method, in which the sum- ation of flows is used for areas under 200 acres, nd on a hydrograph analysis for larger areas. (See lso W70-03148 thru W70-03152) (Knapp-USGS) W70-09534

CITIZENS COMM FOR HUDSON VALLEY V VOLPE (AUTHORITY TO ISSUE PERMITS FOR CAUSEWAY CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09600

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09798

POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09799

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09801

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09802

REGISTER OF SELECTIVE WITHDRAWAL WORKS IN UNITED STATES.
American Society of Civil Engineers.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY9, Paper 7533, p 1841-1872, September 1970. 32 p, 3 fig, 2 tab, 4 ref, append.

Descriptors: *Dams, *Reservoir design, Water quality control, *Outlet works, *Reservoir operations, Drawdown, Reservoirs, Water management (Applied).
Identifiers: Selective withdrawal works.

Tabular data are presented on a number of dam projects in the United States which have provision for selective withdrawal of water from predetermined elevations in a reservoir. The register classifies outlet types, provides information on design ranges, and identifies agencies from whom more specific information might be obtained on projects which may be in operation, under construction, or in the design stage. (Knapp-USGS)
W70-09841

THE EFFECTS OF WATER-SHOCK WAVES ON A HYDRAULIC STRUCTURE,
California State Coll., Los Angeles.
Young C. Kim.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S1, p 174-177, 1967. 4 p.

Descriptors: *Explosions, *Seismic waves, *Underwater, *Hydraulic structures, *Model studies, On-site tests, Dams, Engineering.
Identifiers: *Shock waves, Underwater explosions.

The transient response of a rigid concrete structure to water shock waves was investigated. A theoretical solution of the transmitted underwater shock waves impinging on a concrete structure was obtained by treating it as an entirely Laplace-transformed problem. The effect of the transmitted shock waves on plaster and concrete models was also studied experimentally. Underwater shock waves were created by using a submerged exploding wire in a contained environment. Test results confirmed a theoretical analysis of shock wave propagation in a submerged hydraulic structure. (Knapp-USGS)
W70-09855

STUDY OF PIPE WITH CONCRETE BEDDING--PART II,
American Pipe and Construction Co., Monterey Park, Calif.
Harvey C. Olander, and Gordon G. Robertson.
Proceedings of the American Society of Civil Engineers, Transportation Engineering Journal, Vol 96, No TE1, p 25-44, Feb 1970. 20 p, 11 fig, 7 tab, 2 ref, 3 append.

Descriptors: Design, Concrete construction, Loads (Forces), Geometric shapes, *Pipelines, *Pipes, Stress, *Structural analysis, *Coefficients, *Bedding materials, Concrete pipes, Concrete structures, Earth pressure, Dead loads, *Stress analysis, Internal forces, Hydrostatic pressure.
Identifiers: Buried structures, Concrete blocks, Encasement, Pipe cradles.

Part II of a 2-part study of pipe with concrete bedding is presented. Part I covered the basic case, consisting of a structure with a semicircular top of uniform thickness and a base extending upward to the horizontal centerline with vertical sides and a horizontal bottom. A calculation of stresses throughout the base for the case of 180 deg beding demonstrated that the pipe and bedding act together as a monolithic structure. The previous study is extended to the case of beddings less than 180 deg (sometimes referred to as concrete cradles) and to full rectangular encasements. In both cases, the solution is built on the basic case, and tables prepared previously to simplify the calculations may be used. After developing necessary equations, a sample calculation is presented for a 12-ft-dia noncylinder, prestressed concrete pipe with 120 deg concrete bedding. Using the same technique as in the previous study, stresses throughout the base are determined. Consideration of these stresses demonstrates, as before, that under load there is no tendency for separation of pipe and bedding. This is confirmed by a photoelastic stress analysis of the junction between pipe and bedding. (USBR)
W70-09917

DESIGN OF CYLINDRICAL CONCRETE WATER TANKS,
Harvey C. Olander.
Proceedings of the American Society of Civil Engineers, Journal of Structural Division, Vol 96, No ST5, p 947-973, May 1970. 27 p, 25 fig, 14 ref, 2 append.

Descriptors: Beams (Structural), Cylindrical bodies, Deflection, *Wind pressure, Earthquakes, *Foundations, Structural engineering, Reinforced concrete, Temperature, *Water tanks, Winds, *Hydrostatic pressure, Circumferential stress, Bending moments, Footings, *Concrete structures, Shear, Stress.
Identifiers: Earthquake loads, Elastic foundations.

A comprehensive procedure is presented for design of cylindrical concrete water tanks based on the theory of beams on elastic foundations. Temperature stresses are given careful consideration, including variation of temperature through the tank wall. Analysis shows considerable variation of temperature stresses over the tank. Hydrostatic and earthquake forces are also covered. Wind stresses relating to tanks with varying height-to-diameter ratios are analyzed and design procedures are given. Charts covering temperature stresses and varying types of end restraints to tank walls are provided to facilitate solutions by desk calculator. Sample design calculations for a storage tank on spread footing are included. (USBR)
W70-09918

8B. Hydraulics

WATER TEMPERATURE CONTROL WEIR FOR MERAMEC PARK DAM, MERAMEC RIVER, MISSOURI,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 05D.
W70-09602

ENTRAINMENT IN DEFLECTED AXISYMMETRIC JETS AT VARIOUS ANGLES TO THE STREAM,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05B.
W70-09603

ON THE THEORY OF LONGITUDINAL DISPERSION,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 02E.
W70-09734

ANALYTIC PREDICTION OF LONGITUDINAL DISPERSION COEFFICIENTS IN NATURAL STREAMS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09735

TRACER STUDIES ON TURBULENT DIFFUSION AND DISPERSION,
Chalmers Univ. of Technology, Goteborg (Sweden).
Klas Cederwall.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D3, p 20-32, 1967. 13 p, 11 fig, 3 tab, 2 ref.

Descriptors: *Diffusion, *Dispersion, *Turbulent flow, *Tracers, *Tracking techniques, Dye releases, Closed conduit flow, Open channel flow, Mixing, Mass transfer, Heat transfer, Pipe flow.
Identifiers: Turbulent mixing.

Instantaneous injection of tracer material is an important method for studying turbulent diffusion. The procedure has to be developed and the tracer has to be chosen to suit the particular diffusion

case. Diffusive properties of turbulent flow may be studied by swift point-injections of tracer material. G. I. Taylor's fundamental theory for turbulent diffusion can be adapted to plane injection in a pipe flow. Laboratory investigations show that point injections in the center of the pipe are equivalent to plane injections if the section of injection is displaced virtually in the flow direction. The influence of concentrated losses (constrictions) in the pipe on the turbulent diffusion is transferred to virtual displacements of the point of injection, in the opposite flow direction. The distribution of residence time in a continuous flow system was studied with the same tracer method. An investigation on the hydraulic efficiency of a spiral mixing chamber utilized in water plants for adding chemicals to raw water was based on the concepts of complete mixing and short circuit flow. (Knapp-USGS)
W70-09736

ABOUT TURBULENT DIFFUSION OF SUSPENDED PARTICLES IN FLUID FLOW,
For primary bibliographic entry see Field 02J.
W70-09737

DIFFUSION OF WARM WATER JETS DISCHARGED HORIZONTALLY AT THE WATER SURFACE,
Chuo Univ., Tokyo (Japan). Hydraulic Lab.
For primary bibliographic entry see Field 02E.
W70-09738

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09739

LINEAR-MOMENTUM FLUX TO OVERBANK SECTIONS,
Geological Survey, Atlanta, Ga.; and Georgia Inst. of Tech., Atlanta.
Robert R. Wright, and Marion R. Carstens.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY9, Paper 7517, p 1781-1793, September 1970. 13 p, 10 fig, 2 tab, 2 append.

Descriptors: *Open channel flow, *Floods, *Overflow, *Hydraulic models, Shear stress, Floodways, Hydraulics, Rivers, Streamflow, Routing, Shear drag.
Identifiers: Linear-momentum flux.

On the basis of experiments in two joined rectangular channels, transfer of linear momentum from the major (less restricted) channel to the minor (more restricted) channel has been demonstrated. The apparent-shear stress on the junction surface was found to be of the same order of magnitude as the boundary-shear stress in the major channel. Based upon this observation, a method for engineering calculations for mean-flow characteristics in joined channels such as a river at flood stage is proposed. The steps in the proposed separate-channel method of analysis are: (1) Considering the major-channel boundary including the junction plane as a solid boundary, compute the mean boundary-shear stress on the major-channel boundary; (2) compute the apparent-shear force on the junction surface using the mean boundary-shear stress of the major channel; and (3) incorporate the apparent-shear force on the junction surface as a propulsive force on the minor-channel flow. (Knapp-USGS)
W70-09837

POWER LAW SOLUTIONS FOR VERTICAL PLUMES,
California Univ., Irvine. Dept. of Civil Engineering.
Richard R. Brock.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY9, Paper 7523, p 1803-1817, September 1970. 15 p, 3 fig, 7 ref, 2 append.

Descriptors: *Diffusion, *Jets, *Mixing, *Turbulent flow, *Convection, Vortices, Turbulence, Hydraulics, Mathematical studies, Mathematical models.
Identifiers: Vertical plumes.

This paper investigates solutions to the problem of a vertically rising turbulent plume generated when a source of light fluid is introduced into a heavier ambient fluid of large extent. The particular solutions considered are those in which the plume width, maximum velocity, and maximum density deficiency can be expressed as a simple power of the vertical distance. It is found that this type of solution exists not only for the well-known cases of point and line sources in a uniform ambient fluid, but also for certain cases of: (1) A finite area source in a uniform ambient fluid; and (2) a point, line or finite area source in a stably and unstably stratified fluid. (Knapp-USGS)
W70-09840

DIFFUSION OF SUBMERGED SLUICE GATE FLOW OVER A DROP,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and K. Subramanya.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D17, p 156-163, 1967. 8 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Diffusion, *Jets, *Turbulence, *Sluice gates, *Supercritical flow, Model studies, Flumes, Transition flow, Open channel flow, Hydraulic models, Laboratory tests.
Identifiers: Wall jets.

An experimental study was made of the diffusion of a supercritical stream emerging under a submerged sluice gate situated over an abrupt drop. The length of the eddying region, the characteristics of the velocity profile and bed shear stress after reattachment were studied. After a certain distance downstream of the reattachment line, the supercritical stream could be treated as a reattached plane turbulent wall-jet which behaves very much like the corresponding classical wall-jet. The variation of the bed shear stress is expressed in the form of a dimensionless similarity plot. (Knapp-USGS)
W70-09856

AN ANALYSIS OF SALINITY DISTRIBUTION IN THE STRAITS OF MARACAIBO,
Massachusetts Inst. of Tech., Cambridge, Hydrodynamics Lab.; National Inst. of Canalizations, Caracas (Venezuela); and State Univ. of New York, Buffalo. Dept. of Civil Engineering.
Donald R. F. Harleman, Luis F. Corona-Chuecos, and Emmanuel Partheniades.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D18, p 164-173, 1967. 10 p, 7 fig, 5 ref.

Descriptors: *Saline water intrusion, *Inlets (Waterways), *Mathematical models, *Tidal effects, Currents (Water), Water circulation, Model studies, Tides, Dispersion, Turbulent flow, Open channel flow.
Identifiers: Straits of Maracaibo, Venezuela.

Measurements of salinity distributions were made in the Straits of Maracaibo as part of a general investigation of shoaling problems in the navigation channel. The field data on longitudinal salinity distribution were analyzed by a one-dimensional mathematical model based on turbulent dispersion theory. The salinity distribution at low water slack was compared with the mathematical model and two independent parameters which characterize the longitudinal salinity distribution were determined. These parameters are the longitudinal dispersion coefficient, and a characteristic horizontal length which is of the order of magnitude of t tidal excursion. Laboratory studies show that a co relation exists between a dimensionless form these two parameters and a dimensionless estua number. The estuary number depends on the tid prism, the magnitude of the tidal current, the me depth, the fresh water discharge and the tid period. The salinity data for the Straits Maracaibo conform to the expected correlatio Changes in the salinity distribution due to possib modifications of the channel are discussed. (I napp-USGS)
W70-09857

MATHEMATICAL MODELING OF DISPE SION IN RIVERS,
Vanderbilt Univ., Nashville, Tenn. School of E gineering.
For primary bibliographic entry see Field 02E.
W70-09858

MEASUREMENTS OF THE INFLUENCE O SUSPENDED PARTICLES ON THE SIZE O VORTICES,
Eidgenoessische Technische Hochschule, Zuric (Switzerland). Versuchsanstalt fuer Wasserba und Erdbau.
Andreas Muller.
French resume. Proceedings 12th Congress of th International Association for Hydraulic Researc Sept 11-14, 1967, Colorado State Univ, Fort Co lins, Vol 4 (Pt 1-Microturbulent Diffusion an Dispersion), Paper D12, p 107-114, 1967. 8 p, 1 fig, 3 ref.

Descriptors: *Pipe flow, *Vortices, *Sedimen transport, *Particle size, Turbulent flow, Turbu lence, Velocity, Open channel flow, Roughnes (Hydraulic), Channel flow, Suspension, Suspende load, Fluid friction.
Identifiers: Vortex size.

The influence of particles on vortex size was stu died in rough pipes. The autocorrelation of the velocity fluctuations was considered a measure o the size of the vortices. With this method a ten dency for the vortex diameter to increase with in creasing concentration of the particles can be shown. This effect can be predicted, using a singl vortex model, deducing a faster diffusion of the sin gle vortex. (Knapp-USGS)
W70-09862

EXPERIMENTAL RESULTS OF DYE DIFFU SION IN LARGE PIPELINES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. W. Filmer, and Vujica Yevjevich.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D13, p 115-123, 1967. 9 p, 2 fig, 1 tab.

Descriptors: *Diffusion, *Tracers, *Dye releases, *Pipe flow, *Closed conduit flow, Tracking techniques, Fluorescence, Sampling, Monitoring, Dispersion, Hydraulic models, Hydraulics, Laboratory tests, Reynolds number, Turbulent flow.
Identifiers: Rhodamine.

A study was made of the lateral diffusion resulting from continuous point-source injection of soluble tracers into a 36-inch pipeline at high Reynolds numbers. The tracer, the fluorescent dye Rhodamine WT, was injected at various points along a vertical diameter and at various positions along the length of the pipe. By varying the mixing distance and the flow rate, dye concentration was obtained at various cross-sections for Reynolds numbers up to 1.8 million. The experiments were conducted in a 36-inch 825-foot long pipeline. Injection at a constant rate was obtained by use of a

positive displacement chemical proportioning pump, and downstream concentrations were determined continuously with a flow-through fluorometer. Concentration of the diffused material was obtained for as many as 84 different positions in the cross-section under each given set of hydraulic conditions for mixing distances between 27 and 184 diameters and flow rates up to 62 cfs. (Knapp-USGS)
W70-09863

RADIAL DIFFUSION IN TURBULENT PIPE FLOW,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Bureau of Reclamation, Denver, Colo.
Edward R. Holley, and Jack C. Schuster.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D14, p 124-136, 1967. 13 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Diffusion, *Pipe flow, *Turbulent flow, Tracers, Viscosity, Closed conduit flow, Dispersion, Laboratory tests, Turbulence, Diffusivity, Hydraulics.
Identifiers: Radial diffusion.

Some of the parameters that affect radial diffusion are discussed. The analogy between the radial diffusion coefficient and the eddy viscosity is used to obtain an equation for calculating the diffusion coefficient K. Analytical concentration distributions are presented for steady state diffusion from a source on the centerline of the pipe. The analytical distributions were used to calculate empirical K-values. Forty K-values from various sources are presented. These data show that the amount of lateral spread of the diffusing substance in the pipe has a significant effect on the value of K and that the analogy of diffusion with the eddy viscosity is a fair approximation for K when the diffusing substance fills the pipe cross section. An equation is derived for estimating the distance L required for complete mixing in uniform pipe flow. (Knapp-USGS)
W70-09864

TURBULENT DIFFUSION IN THE HYDRAULIC JUMP,
Technische Hochschule, Karlsruhe (West Germany).
For primary bibliographic entry see Field 02E.
W70-09865

STOCHASTIC SIMULATION OF THE DIFFUSION OF JETS,
Carnegie Inst. of Tech., Pittsburgh, Pa.
Carlos Quevedo, and George Bugliarello.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D16, p 146-155, 1967. 10 p, 8 fig, 8 ref.

Descriptors: *Diffusion, *Jets, *Turbulent flow, *Stochastic processes, *Simulation analysis, Mathematical models, Statistical models, Probability, Laminar flow, Hydraulics, Hydrodynamics, Path of pollutants, Dispersion, Open channel flow.
Identifiers: Jet dispersion.

A stochastic simulation technique was applied to the determination of the velocity field of incompressible jets issuing from a two-dimensional orifice. The diffusion of momentum leading to the formation of the velocity profiles of the jets was achieved by a succession of steps, during each one of which a number of particles were generated at the nodes of a fixed reference grid, and subsequently diffused at random in the direction normal to that of the main flow. Both the laminar and turbulent case were simulated by this technique. The turbulent flow study was based on a phenomenological description of the turbulent field. The results reproduce the basic features of the phenomena, but with the present very simple model, quantitative agreement with experimental and analytical data is not yet fully satisfactory. Refinements of the model to achieve a closer agreement are discussed. The simulation poses no limitations as to the initial scope of the velocity profiles issuing from the orifice or to extension to three-dimensional cases. (Knapp-USGS)
W70-09866

CLOSED CONDUIT TO OPEN CHANNEL STILLING BASIN,
Utah State Univ., Logan; and Colorado State Uinv., Fort Collins.
Gordon H. Falmmer, V. Skogerboe Gaylord, and Wei Chi-Yuan.
Proceedings of the American Society of Civil Engineers, Journal of Irrigation Drainage Division, Vol 96, No IR1, p 1-10, Mar 1970. 10 p, 6 fig, 9 ref, 2 append.

Descriptors: *Closed conduit flow, Closed conduits, Design, Tailwater, *Energy dissipation, Hydraulic models, Hydraulic jump, Hydraulics, *Open channel flow, *Stilling basins, Hydraulic structures, Experimental data, *Model studies, Froude number, Laboratory tests, Diffusion, Submergence, Hydraulic design, Design criteria.
Identifiers: *Energy dissipators, Transition, Experimental models.

Criteria have been developed for designing a stilling basin to serve as a transition from closed conduit flow to open channel flow for a fully submerged pipe outlet. The unique feature of the stilling basin is the short-pipe energy dissipator located and designed to provide maximum energy dissipation for the basin configuration. The expanding characteristics of a submerged jet were used in establishing the length of the stilling basin. The unsteadiness of the water surface and the relative boil height in the model basin were used as criteria for evaluation the effectiveness of the structure for energy dissipation. Relationships among the tailwater depth, outlet flume floor elevation, height of boils in the stilling basin, width of the stilling basin, and amount of freeboard have been studied. Interrelationships among these variables are shown graphically. (USBR)
W70-09914

NON-DIMENSIONAL PROFILE AREA COEFFICIENTS FOR HYDRAULIC JUMP IN SLOPING RECTANGULAR CHANNELS,
Surrey Univ., London (England).
J. W. Wielogorski, and E. H. Wilson.
Water Power, Vol 22, No 4, p 144-150, Apr 1970. 7 p, 13 fig, 2 tab, 11 ref.

Descriptors: *Hydraulic jump, Channels, Profiles, Slopes, Hydraulics, Forecasting, Open channels, Froude number, *Coefficients, Open channel flow, Beds.
Identifiers: *Retangular channels.

The hydraulic jump in a horizontal rectangular channel can be represented by a unique generalized nondimensional profile. The jump in a sloping channel was analyzed and its weight accounted for by using nondimensional profile area coefficients. The coefficients may be related to the generalized profile and the relationship justified by results from laboratory tests using photographic methods. An equation was derived to relate the ratio of depths across a jump on a sloping channel bed to the Froude number. The equation is in the Belanger form, containing profile area coefficients accounting for the jump body weight. The nondimensional generalized profile introduced by Rajaratnam and Subramanya was extended to the sloping channel bed case, and a relationship between the area coefficients and the generalized profile was derived. The analysis and investigation provide data to assist in predicting profile characteristics of the hydraulic jump on a sloping channel bed. (USBR)
W70-09916

REGIME THEORY DESIGN OF CANALS WITH SAND BEDS,
Alberta Univ., Edmonton.
Thomas Blench.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 205-213, June 1970. 9 p, 1 fig, 2 tab, 7 ref, 3 append.

Descriptors: *Regime theory, Canals, *Canal design, *Sands, *Dunes, *Beds, *Dune sands, Open channels, Open channel flow, Tractive forces, Sediment transport, Sedimentation, Froude number, Hydraulics.
Identifiers: *Erodible-bed channels, Bed forms, Bedload movement, Bed movements, Bed ripples, Laceys constants.

Recent regime theory design equations for duned sand-bed canals are outlined and limits of applicability indicated. A simple problem is compared with original Lacey equations. Reference to worked problems and extensions is given. Advantages of the method include: (1) equations derived from data of self-adjusting channels of the type and size for which design is required; (2) provision of the 3 necessary and sufficient independent equations for finding equilibrium values of flow area, depth, and slope; (3) consolidation of the unmeasurables of the water-sediment complex and of the cohesive erodible-depositable sides into 2 overall bed and side factors that can be calculated from the running conditions of existing channels in equilibrium; and (4) simplicity. (USBR)
W70-09929

8C. Hydraulic Machinery

THERMAL EFFECTS STUDIES IN NEW YORK STATE,
Stoller (S. M.) Associates, New York; and Niagara Mohawk Power Corp., Buffalo, N.Y.
For primary bibliographic entry see Field 05C.
W70-09614

HOW SAFE ARE YOUR TOWERS,
Sargent and Lundy, Chicago, Ill.
Joseph R. Arena.
Proceedings of the American Society of Civil Engineers, Journal of the Structural Division, Vol 96, No ST1, p 1-16, Jan 1970. 16 p, 13 fig, 4 tab, 8 ref, append.

Descriptors: *Transmission towers, Transmission lines, Construction, Foundations, Inspection, Wind pressure, *Loads (Forces), Towers, Winds, Safety, Safety factors, Design, Vertical loads, Tornadoes, Fabrication, Structural engineering.
Identifiers: Tower failures, Transverse loads, Auger-type footings.

The need for a new look in transmission line design because of new and higher voltages being used is described. Vertical, transverse, and longitudinal loads and their effects are considered, with emphasis on a correct assignment of the wind load. Tower design is described together with the importance of considering the costs of material, fabrication, transportation, erection, foundation, and maintenance. Foundations and soil borings are noted, and illustrations of the method of constructing the augered concrete caisson-type foundation are given. Fabrication of the steel tower and relation to the tower design are given. Construction and inspection and their relation to the successful fulfillment of a good design and line performance are covered. (USBR)
W70-09911

HYDROELECTRIC POWER IN SIBERIA,
Michael Dankewych.
Military Engineer, Vol 62, No 407, p 184-187, May-June 1970. 4 p, 1 map.

Descriptors: *River basin development, Natural resources, Reservoirs, Electric power production, *Hydroelectric plants, *Hydroelectric power, His-

tory, Reviews, Statistics, River regulation, Dams, Foreign projects, Foreign construction, Industries, Navigation, Multiple-purpose projects, Nuclear powerplants.
Identifiers: *Hydroelectric resources, Installed capacity, *Siberia, Navigation locks, USSR, Surveys (Data collection).

Hydroelectric power development in Siberia is very important to the USSR and of great interest to the rest of the world. Existing hydroelectric developments, those under construction, and the planned potential projects located along the Ob', Irtysh, Enisei, Angara, Lena, and Amur Rivers are discussed. Two atomic plants, the Beloyarsk recently energized, and the Bilibino under construction above the Arctic Circle, are reported. Plant capacities, reservoir storage capacities, surface areas, and drainage basin areas are given. (USBR)
W70-09919

AN ACCELERATION RELAY FOR POWER SYSTEMS,
Bureau of Reclamation, Denver, Colo.
W. R. Roemish, C. L. Clemans, and L. W. Lloyd.
Translation, Paper 70 TP 570-PWR, Institute of Electrical and Electronics Engineers, Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 5 p, 7 fig, 5 ref.

Descriptors: *Electric relays, Frequency, *Frequency shifts, Field tests, *Disturbances, Electronic equipment, Power system operations, Research and development, Sensors, Control, Transducers, Electric potential, Characteristics, Sensitivity.
Identifiers: Power system stability, *Acceleration (Mechanical), Load control, *Solid state devices, Thyristors, Line dropping.

A solid-state acceleration relay developed by the Bureau of Reclamation for data acquisition is a sensitive device capable of measuring the rate of change of frequency at a given location on a power system. The relay has a potential also for use in generator dropping and load shedding schemes. A pilot model of the relay has been installed at the Palisades Powerplant in Idaho to assist in collecting system performance parameters. Data acquired during a major system distrubance demonstrate the potential value of the acceleration relay for sensing behavior and for improving power system reliability. Relay construction, operating experience, and future applications of the device are discussed. (USBR)
W70-09923

ALINEMENT AND MODELING OF HANFORD EXCITATION CONTROL FOR SYSTEM DAMPING,
Bonneville Power Administration, Portland, Oreg; and Bureau of Reclamation, Denver, Colo.
Edward J. Warchol, William B. Gish, and Ferber R. Schleif.
Translation, Paper 70 TP 562-PWR, Institute of Electrical and Electronics Engineers, Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 13 fig, 2 ref.

Descriptors: *Excitation, *Voltage regulators, Nuclear powerplants, *Power system operations, Field tests, Extra high voltage, *Damping, *Control, Frequency, Electric generators, Computer models, Transmission (Electrical), Evaluation.
Identifiers: *Hanford Steam Plant (Wash), *Turbogenerators, Test results, Frequency response, *Power system stability.

The 2 Hanford generators at 430 mw each are presently the largest generating units in the northwest, and their inertias, reactances, and time constants are unusually large. The influence of system damping by voltage regulators is of great interest to electric power system operators. Alinement of speed excitation supplementary control for each of the 2 Hanford nuclear steam turbine-generator units was readily accomplished through field testing. Off-line frequency response tests of the supplementary control units, voltage regulators and exciters, and frequency and step response tests of the excitation systems provided data for developing a dynamic simulation model of the Hanford units. On-line tests with the generators loaded can be made with local forcing signals barely observable and detectable with sensitive instrumentation. Evaluation of results indicate positive damping of the Hanford units. (USBR)
W70-09924

DESIGN OF EHV SUBSTATIONS FOR PEACE RIVER,
British Columbia Hydro and Power Authority, Vancouver.
G. A. Ganason.
Electrical Review, Vol 186, No 7, p 245-251, Feb 1970. 7 p, 10 fig, 1 tab.

Descriptors: *Extra high voltage, *Extra long distance, Microwaves, *Transmission lines, Transmission (Electrical), *Electrical equipment, *Substations (Electrical), Lightning arresters, Bus (Electrical), Power transformers, Electric relays, Circuit breakers, Foreign construction, Electric insulation, Electrical insulators, Condensers.
Identifiers: *Peace River Proj, Can, Current transformers, Series capacitors, Northwest Power Pool, Canada.

Economy and reliability were the main aims in designing switching stations for the 500-kv Peace River transmission system in British Columbia. Power is transmitted from the Gordon M Shrum Powerplant via the Portage Mountain Substation, a distance of 600 mi over 2 single-circuit 500-kv a-c lines in the initial stage and 4 single-circuit lines in the final stage. The 500-kv switching stations at Williston and Kelly Lake divide the lines into 200-mi sections. The Ingledow 500-kv terminal substation near Vancouver forms the load center for the Vancouver area and a load transfer point to the Bonneville power system, connecting into the Northwest Power Pool of the U.S. Schematics for the substations are shown, and major electrical equipment is described. System insulation coordination and protective equipment are discussed. (USBR)
W70-09932

HOLYOKE WATER POWER CO V AMERICAN WRITING PAPER CO (CONTRACT PROHIBITING POWER TRANSMISSION FROM LAND GRANTED).
For primary bibliographic entry see Field 06E.
W70-10022

8D. Soil Mechanics

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS,
Soletanche S A, Paris (France).
For primary bibliographic entry see Field 08G.
W70-09921

TUNNEL SURVEY,
D. G. McBeth.
Tunnels and Tunnelling, Vol 1, No 4, Vol 2, No 1, p 179-182, 23-28, Nov-Dec 1969, Jan-Feb 1970. 9 p, 22 fig, 15 ref.

Descriptors: *Surveying, *Surveying instruments, Survey stations, *Tunnels, Tunnel construction, Control, History, *Methodology, Laser, Theodolites, Measurement, Measuring instruments, Electronic equipment, Bibliographies, Foreign construction.
Identifiers: Construction control, Accuracy, Computer applications, Great Britain.

Past, present, and future tunnel survey techniques discussed include: (1) historical aspects of tunnel surveying, (2) accuracy, (3) surface control surv, (4) transference of surface control und, (5) UNDERGROUND CONTROL SURVEY, (6) tunnel face control while driving, (7) special problems of submerged tube tunnels, (8) microptic theodolites, (9) electronic distance measurement, (10) the precision indicator of the meridian (P.I.M.), (11) lasers, and (12) computation by electronic computer. The golden rule is laying out a survey scheme is to have as few observations of angle or length as is practicable. The only practical means of transferring bearings down vertical shafts is by the wire survey technique. Use of open traverse techniques is the only practical method of extending a survey behind the working face in a tunnel. Because an open traverse is a weak form of control, at least 2 surveys are made. Control of a tunnel face while driving entails tight checks of line, level, and shape of the tunnel and square, plumb, and roll of tunneling shields. By taking full advantage of modern instruments and techniques, an automated system of tunnel control is predicted. (USBR)
W70-09925

BENTONITE SEALING METHODS COMPARED IN THE FIELD,
Bureau of Land Management, Prineville, Oreg; and Agricultural Research Service, Reno, Nev.
For primary bibliographic entry see Field 04A.
W70-09928

8E. Rock Mechanics and Geology

AN INVESTIGATION OF THE DASHT-E BAYAZ, IRAN EARTHQUAKE OF AUGUST 31, 1968,
Coast and Geodetic Survey, Rockville, Md.; and Illinois Inst. of Tech., Chicago. Dept. of Mechanical Engineering.
Kenneth C. Bayer, Lorne E. Heuckroth, and Rajab A. Karim.
Bulletin of the Seismological Society of America, Vol 59, No 5, p 1793-1822, October 1969. 30 p, 18 fig, 3 tab, 9 ref.

Descriptors: *Earthquakes, *Disasters, *Seismic studies, On-site data collections, Faults (Geology), Geologic control, Bedrock, Alluvium, Water table, Earthquake engineering, Water wells.
Identifiers: *Iran, Khorassan Province, Qanats.

Seismological data are presented of the very destructive earthquake that occurred August 31, 1968 in Khorassan Province, northeastern Iran. An analysis is made of the regional intensities, the effects on local structures, and the fresh surface faulting phenomenon. Results are given of studies of temporal and spatial characteristics and the magnitude of all recorded seismic activity before, after and including the major event. Having a magnitude of 7.3, the quake destroyed or severely damaged several villages resulting in 10,000 fatalities and 60,000 homeless residents. The measured fault length was 25 kilometers and surface fractures were noted in many areas. Maximum horizontal displacement was a left-lateral movement of 4.1 meters east of Dasht-e Bayaz, 250 Km southwest of Mashad. Extensive property damage is attributed mostly to poor construction but also to the location of some of the villages on alluvium with a shallow water table. Qanats (shallow well systems) in some places ran dry but irrigation wells 30 meters or more deep were undamaged. (Land-USGS)
W70-09554

DESIGN AND DEVELOPMENT OF A ROCK TUNNELLING MACHINE,
McAlpine (Robert) and Sons Ltd., London (England).
N. D. Pirrie.
Tunnels and Tunnelling, Vol 2, No 2, p 98-103, Mar-Apr 1970. 5 p, 12 fig.

escriptors: Tunneling, *Tunneling machines, Tunnel construction, Tunnel linings, Rock excavation, Rock properties, Construction, Axial oads, Overbreak, Foreign construction, Costs, orque, Overloads, Rocks, Safety, Reliability, oreign design practices.
dentifiers: *Greenside-McAlpine tunneling achine, Great Britain, Machine design, Radial oads, Cutters, Tunnel supports.

he McAlpine tunneling machine, developed for se in soft ground and very soft rock, was quite successful in Great Britain in underground subway ork and in the Toronto Subway in Canada. For ock tunneling, McAlpine combined his machine ith the Greenside heading machine to produce he Greenside-McAlpine tunneling machine with a mall rotating cutting head of about 3 ft dia that raverses along an arm rotating about a horizontal haft. The cutting head first enters the tunnel face n the center then traverses outward while rotating n the arm; all cutting forces are radial, not axial, nd the breakout of rock is in tension to a free face. The tunneling machine and rock picks used on the utting head are described. Better criteria are eeded for assessing the toughness, brittleness, and brasiveness of the rock to be cut. Costs can be educed in machine-bored tunnels; important enefits are: accurate profile, less disturbance of surrounding rock resulting in a safer tunnel, and ess support and lining costs with as much as 30% savings in concrete. (USBR)
W70-09933

8F. Concrete

THE EFFECTS OF WATER-SHOCK WAVES ON A HYDRAULIC STRUCTURE,
California State Coll., Los Angeles.
For primary bibliographic entry see Field 08A.
W70-09855

SHOTCRETE FOR TUNNEL AND SHAFT SUPPORT,
California State Dept. of Water Resources, Castaic.
Shirl A. Evans.
Paper, Calif Water Project, Jan 1970. 46 p, 15 fig, 11 photo.

Descriptors: *Supports, *Tunnels, *Shafts (Excavations), Accelerators, Underground structures, Application methods, *Pumped concrete, Design, Gunite, Concrete placing, Application equipment, Rebound, *Performance, Tunnel linings, Productivity, Rock mechanics, Concrete mixes, Concrete control, Concrete testing, Costs, Tunnel construction, Instrumentation.

Materials, equipment, procedures, and testing used for shotcreting to provide primary and supplementary support for tunnels and shafts on the California State Water Project are described. Information presented is intended to five a basic working knowledge of the shotcrete method of rock support, including design suggestions, mix design, rapid set accelerator use, rock instrumentation, and shotcrete application procedures. The mechanical process and sequence of failure around a tunnel by stress rearrangement pressure is discussed and the action of shotcrete to prevent failure is explained. Design formulas for shotcrete support are presented. Performance data show that shotcrete as primary support prevents rock relaxation and is a practical support system. Shotcrete shows flexibility and compatibility in adding strength and economy to other support systems. Performance in the shafts shows that shotcrete alone could have been uses as support. Comparing grout takes in a section of tunnel supported by shotcrete to a section supported by steel and wood lagging indicates that shotcrete gives better ground support than other conventional systems. Shotcrete accomplishes objectives, of good support, safety, low cost, and speed. (USBR)
W70-09915

MASS CONCRETE FOR DAMS AND OTHER MASSIVE STRUCTURES.
American Concrete Inst., Detroit, Mich.

Journal of the American Concrete Institute, Proceedings, Vol 67, No 4, p 273-309, Apr 1970. 37 p, 7 fig, 14 tab, 52 ref.

Descriptors: *Mass concrete, *Concrete technology, Concrete additives, Concrete structures, *Concrete construction, *Concrete dams, Admixtures, History, Concrete placing, *Concrete mixes, Aggregates, Air entrainment, Cements, Mixing, Temperature control, *Materials, Durability, Formwork (Construction), Heat of hydration, Curing, Bibliographies, Behavior.
Identifiers: *Concrete properties, Volume change, Mix ratios.

A discussion is presented of the materials and practices employed in proportioning, mixing, placing, and curing mass concrete, and of the properties and behavior of hardened mass concrete. Particular emphasis is placed on mass concrete used in constructing concrete dams and other nonreinforced structures usually incorporating large-size coarse aggregate and on the differences between mass and conventional concrete. History of the development of mass concrete practices is presented. Concrete mixes and properties of several dams are tabulated. The report is designed to serve as a reference in designing and constructing concrete dams and other massive concrete structures. (USBR)
W70-09922

SHOTCRETING AT HECLA MINING COMPANY,
Hecla Mining Co.
Gordon M. Miner, and Robert S. Hendricks.
Proceedings, II Symposium on Rapid Excavation, p 7-21-7-37, Sabramento State College, Calif, Oct 1969. 17 p, 1 fig, 6 tab.

Descriptors: *Costs, *Supports, *Underground structures, *Application methods, *Pumped concrete, Concrete placing, Concrete technology, Wet condition, Dry condition, Specifications, Concrete mixes, Accelerators, Application equipment, Rebound, *Performance, Shafts (Excavations), Productivity, Mining, *Tunnel linings, Tunnels, *Gunite.
Identifiers: *Shotcrete, Cost savings, Underground openings, Stopes, *Sprayed concrete, Materials handling, Tunnel supports.

Hecla Mining Company has used successfully shotcrete with substantial cost savings for ground support purposes. Hecla's experience indicates that shotcrete is an extremely effective ground support material that can be used successfully in problem areas where various conventional systems would fail. Hecla's use of shotcrete has been limited to openings where long-term, high-quality support was required, to specific areas where exceptionally difficult ground conditions were encountered, and to a limited degree in stope support. When the necessary engineering and an efficient materials handling system have been accomplished, use of shotcrete on a routine basis in stoping and development situations is anticipated. Shotcreting is a continuous process as compared to the cyclic nature of all other support operations, and offers greater opportunity for mechanization. Therein lies its potential for incorporation into the total rapid excavation system. Operational characteristics of the wet and dry shotcrete processes are discussed. Several case studies are presented. (USBR)
W70-09926

8G. Materials

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS,
Soletanche S A, Paris (France).
Jean J. Janin, and Guy F. LeSciellour.
Proceedings of the American Society of Civil Engineers, Journal of Construction Division, Vol 96, No CO1, p 61-74, June 1970. 14 p, 12 fig, 1 tab.

Descriptors: *Chemical grouting, *Grouting, *Tunnel construction, Soil stabilization, Tunneling, Underground structures, Construction, Control, Foreign construction, *Tunnels, Silicates, Cement grouting, Engineering geology, Cement grouts, Impregnation, Tunneling machines, Consolidation, Injection.
Identifiers: France, *Construction methods, Grouting pressure, Silica gel, Construction practices, Sodium silicate, Grout mixes.

Construction of subsurface structures for a new rapid transit railway line in a major, crowded city like Paris creates special problems. The 30-ft-dia tunnel runs below ground-water level through sands and gravels, underneath existing structures. A shield and mole are used for the excavation. Consolidation of soils is provided by chemical grouting. The technique is also used to consolidate the foundations of a bridge over the tunnel when crossing the Seine. A major station 750 ft long, 130 ft wide, and 60 ft high is excavated in difficult geological conditions complicated by existing services, railway tunnels in operation, and buildings. Silicate and resin grouting provide the consolidation without recourse to compressed air or dewatering. A classification of modern chemical grouts and their limits of injectability is given. Elaborate grouting procedures prove their efficiency in supplementing or replacing modern tunneling methods when grouting is thought to be a reliable construction procedure. (USBR)
W70-09921

8H. Rapid Excavation

RICHARD V KAUFMAN (DAMAGE TO SPRING CAUSED BY BLASTING OPERATIONS).
For primary bibliographic entry see Field 06E.
W70-10014

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

PROGRAM OF THE WATER RESOURCES DIVISION, TEXAS DISTRICT FOR THE 1970 FISCAL YEAR AND SUMMARY OF DISTRICT ACTIVITIES DURING FISCAL YEAR 1969.
Geological Survey, Austin, Tex. Water Resources Div.

U S Geological Survey Information Bulletin, February 1970. 35 p.

Descriptors: *Water resources, *Investigations, *Network design, *Texas, Bibliographies, Publications.
Identifiers: *Basic data network, *Information bulletin, State of Texas, USGS Water Resources Division.

The program of the U. S. Geological Survey, Water Resources Division in Texas consists of collection of basic records through the hydrologic-data network, interpretive studies, and research. This report summarizes the scheduled activities of the Water Resources Division in Texas for the 1970 fiscal year (July 1, 1969 to June 30, 1970) and includes a list of U. S. Geological Survey reports published or released during the fiscal year 1969. (Woodard-USGS)
W70-09836

10. SCIENTIFIC AND TECHNICAL INFORMATION

BIBLIOGRAPHY OF DESALTING LITERATURE - 1969.
Columbia Software, Inc., Fairfax, Va.
For primary bibliographic entry see Field 03A.
W70-09529

CURRENT TRENDS IN GLACIOLOGY,
Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie.
For primary bibliographic entry see Field 02C.
W70-09533

SEDIMENTATION, ANNOTATED BIBLIOGRAPHY OF FOREIGN LITERATURE, 1967-1968 SURVEY NO 5.
Department of Agriculture, Washington, D.C.; and National Science Foundation, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-09556

EFFECTS OF DEICING SALTS ON WATER QUALITY AND BIOTA-LITERATURE REVIEW AND RECOMMENDED RESEARCH,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 05C.
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THE FATE OF NITROGENOUS COMPOUNDS THROUGH SEWAGE TREATMENT PLANTS,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
For primary bibliographic entry see Field 05D.
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SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
For primary bibliographic entry see Field 05D.
W70-09935

BIOLOGICAL FILTERS, (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
W70-09948

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For primary bibliographic entry see Field 05D.
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For primary bibliographic entry see Field 05D.
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Alabama Natural Resources Center	W70-09521, 09771 -- 09774	5
Pennsylvania Institute for Land and Water Resources	W70-09522 -- 09523	2
Nebraska Water Resources Research Institute	W70-09525	1
North Carolina Water Resources Research Institute	W70-09668 -- 09669	2
Wisconsin Water Resources Center	W70-09671 -- 09675	5
C. Other		
Illinois State Water Survey	W70-09524	1
Engineering Aspects of Urban Water Resources (Herbert G. Poertner)	W70-09796 -- 09802	7
Engineering-Sciences, Inc.	W70-09908	1

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